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Willard Nelson Clute, Linnaean Fern Chapter,
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THE FERN BULLETIN.

VOL V.

JANUARY, 1897.

NO. I.

ASPLENIUM EBENOIDES IN VIRGINIA.

BY PROF. W. ALPHONSO MURRILL.

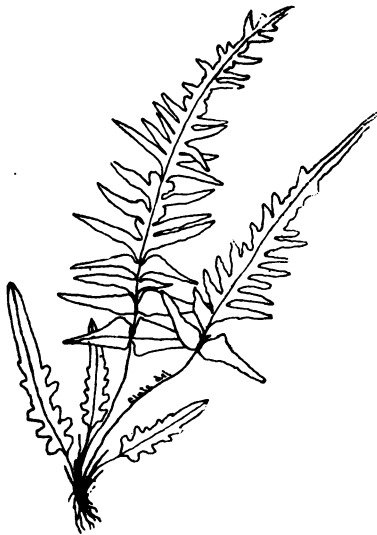
IT was on the hottest day of last July that I found my first plant of *Asplenium ebenoides*. Before leaving Blacksburg I discovered six other plants, in five different localities, but none proved quite so interesting as that first one, which added Virginia to the small list of states that grow the rarest one of all our ferns.

By careful search, however, among our limestone formations, I see no reason why the number of stations for *ebenoides* should not be increased, for it thrives in the light, rich soil at the base of limestone rocks, and nearly as well, so far as my experience goes, in exposed but shaded situations on the side of limestone cliffs. Indeed, judging from the localities where *A. pinnatifidum*, its nearest congener, is found, I should not be much surprised to find it on cliffs of sandstone. One of my plants grew on the eaves of a large mass of chert covered with *Polypodium vulgare*; though this chert was formerly embedded in Lower Silurian limestone. I have also found it here in Virginia with *Pellaea atropurpurea*, *Asplenium platyneuron*, *Camptosorus*, *Asplenium parvulum*, *A. rutamuraria*, *A. trichomanes*, *Woodsia obtusa*, and *Adiantum pedatum*.

When first seen, *ebenoides* suggests a small, prim plant of *Camptosorus* which has found its situation uncomfortably sunny and holds up its half-grown tips at a safe distance from the dry earth. On closer examination, the body of the frond is seen to be pinnatifid, and the sori of true *Asplenium* type; so our find must be either *A. ebenoides* or *A. pinnatifidum*. Although these two ferns resemble each other closely in size, color, texture and general outline, I think it is possible with several specimens before me, to point out some well-defined differences.

Asplenium 6

-2-



ASPENIUM EBENOIDES. (One-half natural size.)

The stipe of *ebenoides* is rich purple and polished, as is also the rachis on its under side, sometimes even beyond the middle of the frond; while the stipe of *pinnatifidum* is dull purplish only at its base. A few of the lower pinnae of *ebenoides* are separate, while in *pinnatifidum* there is a distinct green wing connecting them all. *Pinnatifidum* retains its pinnatifid character to the very tip, while the fronds of *ebenoides* often show extreme jaggedness and irregularity at the base, and become wavy-margined or entire at the apex. The pinnae of both ferns vary from broadly ovate and obtuse to sharply lanceolate in outline. I have several prolific fronds of *ebenoides*, but none of *pinnatifidum*. On the other hand *pinnatifidum* bears much more fruit, its pinnae being often entirely covered beneath. Other structural peculiarities of *ebenoides*, that do not appear to the unaided eye, are mentioned in the discussion of the interesting theory of hybridity, to which we now turn.

Thirty years ago it was suggested that *A. ebenoides* might be a hybrid between *Asplenium platyneuron* and *Camptosorus rhizophyllus*. In Eaton's "Ferns of North America," we read that it

has always been found with these ferns, and that the hybrid theory of Berkely "certainly appears probable." The "Synopsis Filicum" (1868) classes it under *A. platyneuron*, as the fern which it most closely resembles; while the basal sori of nearly every segment, and the proliferous apex seem to connect it with *Camptosorus*. Another interesting link connecting it with the walking-leaf is the areolate structure of its veins. Eaton's book says: "The veins are everywhere free," and none of the manuals deny the statement; but nearly all the specimens I have examined show a very few areoles between the middle and the apex of the frond. However, a month's experience with the fern in its native haunts has shaken my firm belief in the hybrid theory. To my mind, *ebenoides* has uniformly appeared as a distinct spleenwort, and he who would impeach its title to specific rank must bear the burden of proof. The vascular bundles of *ebenoides* are like those of *pinnatifidum*, *platyneuron*, and other closely related spleenworts, and though proliferous, as *pinnatifidum* and *platyneuron* sometimes are, no fronds have been found actually rooting at the tip. With hybrids, there is usually a complete gradation from one parent to the other, but none of the variations of *ebenoides* appear to approach the supposed parents. At Havana Glen, Ala., *ebenoides* is said to grow in profusion, while its supposed parents are present only in small numbers. Young plants, too, are there in abundance, most probably descended from spores; for I find that, though the sporangia of Virginia forms are mostly filled with black, dusty masses, the specimens from Alabama yield several spores that look as if they might grow. But here I need more time for an investigation. Much remains to be learned, and any helpful suggestions will be very gratefully received. I am already deeply in debt to Messrs. W. N. Clute, C. E. Waters and Alvah A. Eaton, and Dr. L. M. Underwood for valuable aid in the preparation of this article.

LYCOPODIUM ALOPECUROIDES IN MASSACHUSETTS.

ON the 4th of September, 1896, while botanizing on Plum Island, I came across a cranberry bog, of which there are several on the south half, in which I found an abundance of *Lycopodium inundatum*, and what appeared at the time as a very odd form of it, very unripe. Calculating it would be about right on Oct. 5th; I made another trip to the locality, and found

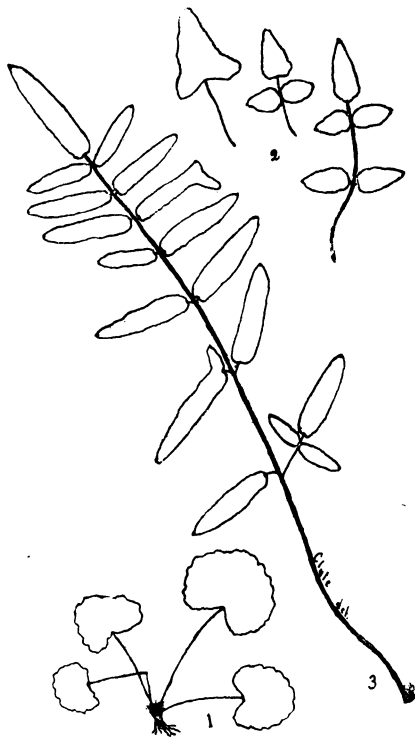
that a part was about right to get, and the rest unripe. Meanwhile the inundatum had ripened, about two weeks or so later than in other localities. It was the best I ever saw, spikes of two inches in length being not uncommon. The then unknown species was taller, with slender spikes, appressed scales, mostly green in color, with longer and stouter sterile branches. I found on getting home that it was identical with some alopecuroides I had from Atsion, N. J. As the botanies do not seem properly to distinguish this, I will give the result of my investigation, and of the locality, that others may be on the "look" for it.

Plum Island is a long sand-dune, or series of dunes; "a whale aground," Whittier calls it, about six miles in length, facing the ocean between the Merrimac and Ipswich rivers. Among these dunes, especially at the south end, are depressions in which cranberries grow, and often various trees, as poplar, juniper, maple, alder, etc. The dunes often migrate into these depressions, covering the trees till nothing but the tips of the branches protrude. In such a depression among cranberries, I found the Lycopodium. The most striking thing about it is the great number of spikes, from three to seven, while inundatum has rarely but one. Another thing is that the sterile stems do not die in the winter, as inundatum, but persist till the next summer, and the terminal part becomes bulbous thickened and often proliferous after the year's growth has ceased to sap it, especially in vigorous shoots. The leaves are longer, less spreading, and more ciliate than in inundatum. The fertile stems are (here) 6 to 8 inches high, the scales less spreading than in inundatum, and fruit ripening later. The most peculiar thing is, that the vigorous shoots have two spikes or more that are about equal in size, and one to five more or less abortive ones gradually decreasing in height and fertility till the middle of the stem is reached. Those farthest removed from the base are nothing but sterile stems or spikeless peduncles, often showing a tendency to revert in depauperate forms, by being variously divided at top and often the divisions bent down as if trying to find the earth to root in. This is a migratory species. The vigorous shoots are always on the outside of the patches, traveling away from the center. The inner ones are always depauperate, as if the first growth had exhausted the soil. The patches are usually small and the plants of the center often have sterile stems but 1-3 inches long not rooted at end, sending up 1-3 peduncles, but having little or no fruit, in fact, are about to die

at once. The general aspect of this is that it is unhappy in this northern locality. This species should be sought in the cranberry bogs of Cape Cod.—*A. A. Eaton, Seabrook, N. H.*

YOUNG FERN FRONDS.

NOT all the interest in fern study is confined to the mature plants; the first tiny fronds that spring from the prothallus are worth our attention. Very little has been done in this field, although few offer better opportunities for original work. Our knowledge of the shape and appearance of most young ferns



PELLÆA ATROPURPUREA.

Fig. 1.—Young plant, natural size. Fig. 2.—Small fronds from older plants natural size. Fig. 3.—Mature frond, reduced one-half.

is so limited at present that few of us are prepared to name [a species with certainty until it has fruited. So greatly do the early fronds of some species differ from the mature ones, that one may easily confuse them with other species. This is especially true of *Dryopteris spinulosa* and its varieties. The young fern must be nearly a year old before we can be sure that it is not some other member of the family. Another fern with even a more striking metamorphosis is *Pellaea atropurpurea* illustrated herewith. The young plants (Fig. 1) have very thin fronds, roundish-heart-shaped in outline and do not in the least resemble the thick heavy fronds found on mature plants; (Fig. 3.) These juvenile, round-leaved fronds do not fruit, though close beside them may be found plants no larger with pinnate fronds bearing sporangia (Fig. 2.) which shows that age and not size is responsible for the change in outline. With a little care one may select a series of fronds showing just how the change is made. Starting with the cordate fronds, we find the next inclined to become triangular or auricled at base, and in subsequent fronds these auricles become distinct pinnae. Later fronds show two pairs of pinnae, both apparently derived from the terminal one, and it may well be questioned whether the dozen or more pairs of pinnae sported by larger fronds were not also derived in their turn from the single terminal pinna. It is probable that investigation of the infant fronds of other species will yield as interesting results. To the courtesy of Mr. C. E. Waters, of Baltimore, Md., we are indebted for several valuable notes on this subject, and also for the specimens from which the drawings for our illustrations were made.—Willard N. Chute.

LYCOPODIUM SELAGO L

THIS little plant grows within our range on high mountain tops, and was collected by the writer on the sub-alpine summit of Roan Mt., N. C., this summer, at an altitude of about 6,400 feet, 200 feet higher than Mt. Washington. It grows there in abundance, usually rooted under the edge of small rocks or stones, and sending out stems which curve up and fork into flat-topped clusters, the whole effect reminding one a little of tiny candelabra. At first sight the plant might be mistaken for a dwarfed form of *L. lucidulum*, the general structure and appearance of the two being very similar, and the spores in both species being borne in bright yellow sporangia in the axils of the upper

leaves, not in spikes. The specimens of *L. selago*, however, which came under my notice, lacked the brilliant, shiny green of their larger cousin, and were from about $1\frac{1}{2}$ to 4 inches in height. This species is a lover of the cold, and according to Hooker's "*Flora Boreali-Americana*," is found northward to the extreme Arctic shores and islands. In the valuable herbarium of the Academy of Natural Sciences at Philadelphia, specimens are preserved which were collected by Dr. Kane's polar expedition, and also some brought from Greenland by the Heilprin expedition of 1891. The presence of the plant so far south as North Carolina is therefore very interesting, but it has congenial company on its cool mountain top in *Arenaria Grœnlandica*, *Alnus viride*, *Potentilla tridentata*, *Solidago virgaurea* (var.), etc.—characteristic northern species. *L. Selago*, in common with the other species of the genus, discharges its spores in the form of a copious yellow powder, which is very inflammable. Anyone desiring an impromptu pyrotechnic display, may have it by shaking the mature plant over a lamp flame, the falling spore-dust changing like magic to a shower of brilliant stars.—*C. F. Saunders, Philadelphia.*

ABNORMAL FRUITING FORMS OF *OSMUNDA CINNAMOMEA*.

THE explanations offered in the July BULLETIN by Geo. F. Atkinson and A. A. Eaton to account for the cause of so-called varieties of *Onoclea*, *Osmunda* and other ferns, have recently been verified to me by accidental circumstances. On the 10th of September I visited the swamp where I found the specimens which were described in the BULLETIN of last January. The swamp is gradually being transformed into a celery garden and fire has been used to a considerable extent in clearing the surface. At my last visit I found a considerable area of thirty square rods or so that had been burned over within a very few weeks so that every green thing had been destroyed. Over this blackened space there was scarcely a fresh growth to be found except at the summits of the numerous rootstalks of *Osmunda cinnamomea*. Nearly all of these had put forth new fronds, the number [from each stalk ranging from one to a dozen. In nearly every case the first frond to appear had been fertile in a greater or less degree, a few seeming as perfect as those produced in the usual season. Unquestionably the fire had induced the ferns to send up the fronds

that were most advanced in preparation for next season's work of fruiting and growth. It seems perfectly clear to me now that any apparent deviation in a frond from the sterile towards the fertile form is in reality a reversion from an intended fertile form, and that the degree of reversion is inversely proportioned to the development of the embryo frond at the time of the accident that affects its destiny. It is not clear to me why the reserve fronds should be put forth so late in the season. The leaves destroyed by the fire had nearly or quite completed their work and must have been in a dying condition when burned away. That there was need of more leaves to elaborate growth material does not appear probable, and it seems as if the fire must have had a stimulating effect not entirely in the nature of a necessity.

I collected and preserved the out-put of some sixty stocks, keeping each separate. If any member of the Chapter is wanting such material, I shall be pleased to send to such as may request it a selected series illustrating the steps of modification. One who is collecting merely to make up a beautiful herbarium will have no use for these, as most of the specimens are dwarfed and unsightly from various causes. Many of the more fertile ones were brown and withered when found.—*C. D. McLouth, Muskegon, Mich.*

THE SPORES OF DRYOPTERIS MARGINALIS.

THE spores of *Dryopteris marginalis* are really brown, although in many cases the sori and even the spores while still in the sporangia appear to be black. Attention was called to this on page 46 of the July BULLETIN and the matter was looked into. The sori were scraped off and placed under the microscope and pressed down gently, so as to squeeze out the spores as there were present both green and black sporangia. When a drop of strong alcohol was allowed to run in under the cover glass the spores were discharged, and it could be seen that those from the black-looking sporangia were brown. The others of course were green. It must not be imagined that the function of the jointed ring in "discharging the spores" is the rather passive one of straightening out, thus rupturing the sporangium and letting the spores drop out. That used to be my idea of the operation until one day I was startled by seeing the ring straighten out and instead of stopping, keep on its course until it had made almost a complete ring in the opposite direction. Then it suddenly straight-

ened and shot the spores out of the field. Anyone with even a "boys" microscope can see this by taking sporangia and letting a drop of alcohol or glycerine run in under the coverglass. My first surprise was with sporangia that had been kept moist some days in a tin box. As they dried in the air the above mentioned result was obtained. It can be easily seen that the spores will not be shed in rainy weather, when they would be beaten down to the ground without much chance to be spread with the wind. Several other species besides *Dropteris marignalis* has black sporangia frequently. *Woodwardia areolata*, *Cystopteris fragilis*, *Onoclea sensibilis*, *O. Struthiopteris* and *Dicksonia punctilobula* may be mentioned.

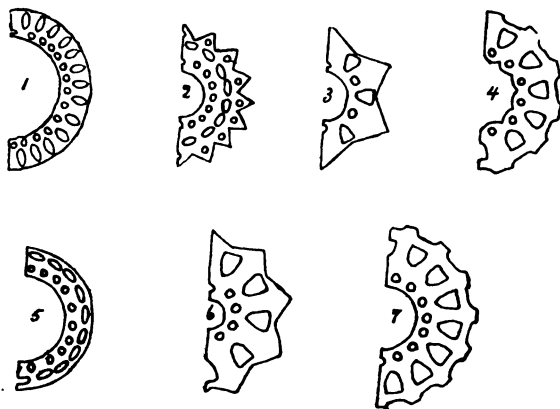
THE SPINY SHIELD FERN IN ALASKA.

A *SPIDIUM spinulosum dilatatum* (wood fern) is abundant in rich, open woods near sea level, and the rootstock or caudex is highly relished by the natives who cook and eat it in large quantities, it being the first vegetable food which they obtain in early spring. The method of preparation is as follows: The rootstocks are dug from the ground soon after the snow disappears, before the fronds are developed, and are trimmed and washed. A round, well-like hole, three feet in diameter and two and one-half feet deep is then dug, hot stones are placed in the bottom, or stones are placed there and a fire built upon them until they become hot. The fire is then removed, a layer of damp moss or kelp is laid on the stones and the cleaned root-stocks placed therein until the hole is full. A little water is then thrown on the pile which is then hastily covered with a layer of damp moss, or a couple of cedar bark mats are laid on and earth to the depth of about ten inches is put over it. On this a fire is built and kept up all night. The next day the contents are taken out and are then ready to be eaten, the outer rind being removed with the fingers or a small knife. It has a slightly sweetish taste but is too smoky and tobacco-like in flavor for the average white man's palate except under stress of hunger, though I have no doubt it is quite nutritious — *M. W. Gorman, in Pittonia*.

Mr. Stewart H. Burnham has a plant of *Scolopendrium* in cultivation which has had more than forty living fronds at one time.

IDENTIFYING EQUISETUMS.

AN interesting method of identifying the horsetails is by the examination of their stems. Nearly all have very characteristic outlines. Below is an illustration of several of our common species, which we reprint from "Wayside and Woodland Blossoms," by permission of Messrs. F. Warne & Co., N. Y.



HALF-SECTIONS THROUGH HORSETAIL STEMS.

- | | |
|-------------------------------|---------------------------|
| 1.— <i>Equisetum maximum.</i> | 4.— <i>E. sylvaticum.</i> |
| 2.— <i>E. pratense.</i> | 5.— <i>E. fluviatile.</i> |
| 3.— <i>E. arvense.</i> | 6.— <i>E. palustre.</i> |
| | 7.— <i>E. hyemale.</i> |

LYCOPODIUM CAROLINIANUM.

ONE of the daintiest of our American Lycopodiums is *L. Carolinianum*. Its furthest habitat north seems to be New Jersey, in the pine barrens of which state it is abundant, loving to frequent sandy swamps. The sterile stems lie flat on the ground and cling so tenaciously to their sandy bed that it is difficult to collect the plant except in fragments. At first sight it might readily remind one of a rather coarse selaginella, but the slender, delicately poised fruit spikes will readily distinguish it from that tribe.—*C. F. Saunders.*

Mr. E. C. Kent of East Wallingford, Vt., has discovered a form of *Lycopodium clavatum* in his vicinity that produces sterile stems twenty inches high.

Two Odd *Ophioglossums*.

While collecting *Ophioglossum vulgatum* on July 12, I found two that present an interesting case of reversion. One of these has a spike with 19 sporangia on one side, on the other side the six terminal sporangia were normal. Below this there was no evidence of fruiting, the axis being expanded and leaf-like. The other plant had a spike 1 in. long, the lower half being normal, and the upper flat and leaf-like. This shows that the spike is a modified leaf, which, of course, was known before; but it is remarkable that in a plant of such simplicity the essential organs should be so completely aborted. *Botrychium* presents fertile sporangia, or even fertile spikes, on the sterile branch, but I have never found the spike reverting to a leaf.—A. A. Eaton.

OUR MISCELLANY.

Mr. Howard P. Wells of Philadelphia, has recently collected a plant of *Asplenium ebenoides* in Monroe county, Pa., some ten miles above the Delaware Water Gap. The plant was surrounded by luxuriant specimens of the walking fern and ebony spleenwort.

Polypodium polypodioides is quite common here. Its favorite places of growth are on rocks and tree trunks near the ground. It is most commonly found on rocks where there is but little earth, and often a mass of it may be stripped from the rock leaving it bare. In time of drought it will roll up and seem dead, but a little moisture will soon revive it. I have rarely found it on tree trunks, though Chapman gives that as its place of growing.—H. A. Green, Chester, S. C.

In the article "*Dryopteris simulata* in Maryland," it may have struck many of the readers of the BULLETIN as strange that the sterility of *D. thelypteris* growing near *D. simulata* was particularly mentioned. In Mr. Davenport's original article it was stated that the latter species is found "growing naturally and fruiting heavily under conditions where *D. thelypteris* is invariably weak-growing and sterile." My mention of the fact was to confirm this argument against the hybridity of *D. simulata*, first advanced by Mr. Davenport.—C. E. Waters.

Having lived not far from Atsion, N. J. for some years, I visited the *Schizæa* locality several times. At Quaker Bridge the plant was found; I think on the left side of the bridge going from

Atsion, but not abundantly. But on the right of wagon road, a mile or so nearer Atsion, and along the brink of the river, I found considerable quantities. My experience was that the fern was found more easily by the fruiting fronds, which were the full size —3 to 5 inches. The sterile fronds look so much like grass as not to be readily recognized.—*H. A. Green, Chester, S. C.*

Lycopodium alopecuroides and *Woodwardia areolata* are reported from a bog on Mt. Pocono, Monroe county, Pa., by Mr. Howard P. Wells, who remarks that this is rather far from the coast for these plants.

Mrs. C. B. Graves, New London, Conn., reports a plant of *Botrychium ternatum* which has an extra fertile stem rising from the stalk of the fertile segment. She also records the occurrence in her locality of *Dryopteris cristata* \times *marginalis*.

Although the fronds of *Asplenium angustifolium* are simply pinnate, while those of *Asplenium acrostichoides* are bipinnatifid, there is a great resemblance between them. Both frequent the same places, and at a little distance it is hard to distinguish one from another.

Miss Imogene C. Stickler notes that last summer at Point Albino, Ont., she collected a frond of *Asplenium angustifolium* that measured forty-eight inches in length. Others collected at the same time ranged from thirty-nine to forty-six. This is much larger than this fern usually grows.

Mr. Howard P. Wells sends a drawing of a peculiar form of *Osmunda cinnamomea* which he has observed in the Catskill mountains and in Monroe county, Pa. In this there is a smaller pinna at the base of each of the main pinnæ, and several of the pinnules on the large pinnæ are lobed on the side towards the rachis.

In the so-called variety, *campestre*, of *Equisetum arvense*, nature shows us how both fertile and sterile stems of the plant are derived from the same source, although they are so different when mature. The pale, brownish-yellow fertile spikes that appear in early spring seem most unlike the green, branched sterile stems that push up later, but the former sometimes show their relationship by producing a few green branches at the base, while the latter frequently develop small fruiting spikes at the summit.

Equisetum robustum and *Adiantum capillus veneris* have been found in Delaware County, Pa., by Mr. T. C. Palmer.

Mr. C. F. Saunders reports collecting *Asplenium ruta-muraria* in North Carolina last summer. The plants were very scarce. This seems to be this fern's southern limit. Does anyone else know of its occurrence so far south?

Mr. Geo. E. Davenport writes that the bases of the previous year's stipes remain on the rootstalk of *Dryopteris Novboracensis* and *thelypteris* as well as *simulata*, and that in consequence this character cannot be relied upon for distinguishing *simulata* from its near relatives.

The original locality for *Asplenium ebenoides* is on the Schuylkill river, above Manayunk. The Herbarium of Lafayette College has a specimen from this locality, collected in 1867. The other known stations for this plant are Havana, Ala.; Canaan, Conn.; Poughkeepsie, N. Y., Jackson Co., Ill., and Hanover, Ind.

The statement made in the July number that *Asplenium viride* has been collected in Connecticut is now found to be a mistake, *A. ruta-muraria* having been mistaken for it. In Mr. James N. Bishop's list of Connecticut plants, *A. viride* is reported from Waterbury, but is said to need verification. An authentic record of the occurrence of this fern in Connecticut is yet to be made.

Under date of Nov. 26, 1896, Prof. Murrell writes: "A trip to Weyer's Cave, Va. to-day discovers a beautiful plant of *Asplenium ebenoides* among the *A. parvulum* above the entrance. This encourages the hope I had entertained of finding this species almost anywhere in our valley, but very rare. The plant has been reported from several widely separated localities and probably exists at numerous stations in the intervening territory. Fern students should be on the watch for it."

One thing about *Dryopteris simulata* not noted is its proneness to the attacks of a worm that eats the spores as they mature. In some places where it is abundant it is almost impossible to get a perfect frond for this reason, especially in the latter part of September. The nuisance attacks other ferns also, but none so bad as this. It spins a fine thread that makes a kind of shelter for it. It is a bad thing to "go to press" as it often eats and completely destroys good specimens after you think you are rid of it. It is apparently the larva of one of the leaf-rollers, of the family Tortricidae.—A. A. Eaton.

Lycopodium selago is said by Dr. Thomas C. Porter to have been collected at the famous Delaware Water Gap in Pennsylvania.

In the *Bulletin of the Torrey Botanical Club* for April, 1896, Mr. John K. Small records two additional stations for *Asplenium Bradleyi*, namely: Kings and Crowder's mountains in North Carolina. It grows both on the cliffs at the summits and in crevices on large boulders on the slopes.

In *Garden and Forest* for October, 1896, Mr. George E. Davenport has an article on *Dryopteris cristata* \times *marginalis* in which he reaffirms the right of this plant to recognition. The article is accompanied by a full-page plate showing the principal differences between this and the ferns nearest like it.

Writing of the occurrence of *Asplenium ebenoides* in Havana Glen, Ala., Prof. Underwood says in the November *Botanical Gazette*: "Many have regarded it as a hybrid, but the display of the species at Havana clearly demonstrates that it is not a hybrid at all. Its nearest congener is *Asplenium pinnatifidum*, but the frond is much thinner and more irregular than that species. In habit, however, it is very close to that species, growing far under overhanging rocks; in this respect it is totally unlike both *A. platyneuron* and *Camptosorus rhizophyllus*, its supposed parents. It appears to be multiplying, as many young plants were seen in the rock crevices. This myth of hybridity may be put aside, for *Asplenium ebenoides* is as clearly defined a species as we possess in the genus *Asplenium*, and has no near relations outside its own genus."

The list of forking fronds continues to grow longer. Messrs. C. E. Waters and Will R. Maxon record forking fronds of *Asplenium platyneuron*; Mr. Maxon notes the forking of *Pellaea gracilis* and *Dryopteris noveboracensis*; Miss Imogene C. Strickler mentions a forking frond of *Onoclea Struthiopteris*; and Mrs. M. E. Russell sends a frond of *Dryopteris cristata* that forks. This brings the list of species up to thirty-seven. Doubtless the fern that forks most commonly is the *Scolopendrium*, a plant with long entire, plantain-like leaves, the very species in which one would not expect to find this trait. Last September the editor spent a day with Mr. Will R. Maxon in the haunts of the *Scolopendrium* and more than twenty-five forked fronds were collected without making any special effort to find them. One much divided specimen was forked six times.

Fern lovers who are searching for *Dryopteris simulata* should not base its identification upon the sterile fronds. *Asplenium acrostichoides* has sterile fronds almost exactly like those of *simulata*, and to make the difficulty still greater, both are veined alike.

The statement in our number for July, 1897, that *Dryopteris fragrans* has been found growing in great quantities on Spruce Knob, West Virginia is shown to be erroneous, *Dicksonia punctilobula* having been taken for it. The fern is locally known as Sweet Fern.

In response to several requests we herewith publish the list of American ferns with forking fronds, using the numbers of the 'Fern List,' 2, 13, 40, 51, 67, 68, 90, 92, 93, 99, 102, 101, 107, 108, 109, 110, 111, 112, 120, 128, 131, 133, 138, 140, 142, 145, 146, 147, 151, 152, 154, 155, 156, 163, 165, 172, 181, 183.

THE LINNÆAN FERN CHAPTER OF THE AGASSIZ ASSOCIATION.

—The reports of the Chapter officers for 1896 will soon be printed in pamphlet form and sent to all members.

—During the first week of last July one of our active members made a collecting trip on foot, through one hundred and twenty-five miles of the Virginian Alleghanies.

—Members of the Chapter whose dues are paid to the end of 1897 will receive a copy of Dodge's "Ferns and Fern Allies of New England" free. Copies will be sent to others as soon as the remittance for dues is received.

—The October election gave us officers for 1897 as follows: President, C. E. Waters, John's Hopkins University, Baltimore, Md. Vice-president, Mrs. A. D. Dean, 329 Washington Ave., Scranton, Pa. Secretary, Alvah H. Eaton, Seabrook, N. H. Treasurer, James A. Graves, Susquehanna, Pa.

—The annual dues of the Chapter are payable in January of each year. The Treasurer will send notice to each member of the amount due, and it is hoped that none will pay beyond the end of the year, unless it is to pay up to the end of some other year. It will save much confusion in the Chapter if all memberships expire with the end of each year.

—The Fern Chapter is now represented in twenty-three states and claims to be the largest corresponding Chapter of the Agassiz Association, both as regards the number of members and the area over which it is spread. Maine, Florida, California and Washington contain members of the Chapter, with a liberal sprinkling of students at intermediate points.

—In spite of the fact that there has been a general depression in business, the Fern Chapter continues to grow. More new members have been admitted during the last quarter than for any like period in its history. The names of these new members, as well as the names of all others who have joined since our last list of members was issued, will be printed in the pamphlet containing the officers report for 1896.

The Chapter Ferns.

During the past season our members have had less fortunate ones in mind when collecting rare ferns and the result is the excellent list of rarities offered herewith. Mr. C. F. Saunders heads the list with specimens of *Lycopodium selago*, collected on Roan mountain, N. C.; *L. Carolinianum*, from Egg Harbor, Pine Barrens, N. J.; *Asplenium montanum*, collected on limestone along the Susquehanna at Lancaster, Pa., and *A. ruta-muraria*, collected along Bushkill creek, Northampton, Co., Pa.; Mr. H. A. Green, Chester, S. C., sends plants of *Cheilanthes lanosa* and *Polypodium Polypodioides* from South Carolina; from Mr. Alvah A. Eaton, Seabrook, N. H., comes a series of specimens of the genus *Equisetum*. This comprises *Equisetum litorale elatius*, *E. l. arvensiformis*, *E. l. gracile*, *E. l. humile*, *E. Arvense campestre forma macro* and *microstachya*, and *E. a. decumbens*, *Pteris serrulata*, a fern rather common in greenhouses is also offered. These have been made up into packets and offered to members only, as follows: the six specimens of *Equisetum*, 15 cents; the two *Aspleniums*, 5 cents; the two *Lycopodiums* and *Polypodium polypodioides*, 7 cents; *P. polypodioides* and *C. lanosa*, 5 cents. The packages will not be broken. Part of the *Cheilanthes* was wrongly labelled; it is all *lanosa*. To those who have sent ferns for distribution within a year, any of these will be sent free upon request. In the majority of cases the supply of ferns is exhausted within ten days after the BULLETIN is issued. Those who would be sure of specimens should write at once. Address everything upon this subject to Willard N. Clute, Binghamton, N. Y.

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To Our Friends:—

Contrary to the expressed wishes of many of our subscribers we have again enlarged the pages of this journal. This step was taken in answer to a demand for more space and also with the hope that a larger size may dispel the idea (current in some quarters) that small pages must contain matter of small importance written by novices. To all, we now say that so long as the journal remains under its present management, the size of the page will not be changed again. Further enlargement will come through an increased number of pages or more frequent issues.

With this volume the subscription price has been raised to fifty cents a year. This increase in price will not affect any of our present subscribers. Those whose names are on our books may renew as often as they please at the old rate of thirty-five cents, but after January 31st, all **new** subscriptions must be made at the new rate.

It has not been an easy task to make a journal devoted entirely to ferns, self-supporting. Our success has been due, in no small part to the assistance rendered us by fern students, in sending us subscriptions and in making the journal known to others. We take this occasion to acknowledge our appreciation of their support.

The future of the FERN BULLETIN is largely in the hands of fern lovers. With a wider circulation we shall be able to pub-

lish a greater amount of matter, with more illustrations. We believe we now reach more people interested in ferns than any other botanical journal, but we shall be unable to render the best service possible, until the names of all who are interested in ferns are on our subscription list.

* * *

A COPY of this issue goes to every person who has asked for a sample copy since the FERN BULLETIN was started. A change in our mailing lists will prevent subsequent numbers going to these addresses from which a subscription has not been received in the meantime.

* * *

A LITTLE investigation has seemed to prove that nearly every fern occasionally bears forking fronds. A trait much less common and even more curious is found in ferns that root at the apices of the fronds or at the ends of pinnæ. The walking fern easily leads in this respect and the few others that are known to have this peculiarity are all its near relatives. Besides *Camptosorus*, the list includes *Scolopendrium*, *Asplenium*, *pinnatifidum*, *A. Ebenoides* and *A. platyneuron*. Who can add others?

* * *

In connection with the notes on *Asplenium Ebenoides* in this number, it may be remarked that this fern possesses one prominent characteristic of hybrids in its extreme variability. We have recently seen specimens of this fern collected by Prof. L. M. Underwood in Alabama, in which the length and cutting of the pinnæ varied to a remarkable degree, even in the same fronds. It may also be of interest to note that the illustration for this number is an exact reproduction of a plant sent from Alabama by Prof. Underwood. The three smaller fronds are apparently sporelings analogous to the round leaved forms of *Pellaea* shown in this issue.

* * *

MR. ALVAH A. EATON of Seabrook, N. H. is preparing a series of studies in the genus *Equisetum* for this journal, and is desirous of obtaining specimens belonging to the group from all parts of the country. He offers in exchange many rare and desirable ferns. It is hoped that a large number will respond to Mr. Eaton's request for material, and thus aid in making a good monograph of the genus.

NOTES.

—An excellent article on the Hart's-tongue fern appears in the *University Forum* of Syracuse, N. Y., in the issue of Nov. 3, 1896. It is from the pen of Mr. Will R. Maxon.

—The *Observer* of Portland, Conn., which has been for the past seven years one of the prominent natural history magazines, suspended recently. The general depression in business is given as the cause.

—In the *Botanical Gazette* for November, 1896, Prof. L. M. Underwood reinstates a species of *Botrychium* which has long been known as *B. ternatum* var. *lunarioides*, but which is there shown to be a very distinct species possessing characteristics which clearly separate it from its allies. The plant was first collected by Michaux in South Carolina, and was described by Lamarek in 1797 as *Osmunda biternata*. Subsequent authors have called it *Botrypus lunarioides* and *Botrychium lunarioides*. It is now given its rightful place by Mr. Underwood as *Botrychium biternatum*.

—We have left just ten sets of Vol. IV, minus the first number. While they last the price will be thirty five cents a set. Prior to Vol. IV the BULLETIN was issued expressly for the Fern Chapter. In addition to the Chapter business, it contains forty-three articles on ferns, besides hundreds of other notes. One of these issues was the "fern list." We have no complete sets of these early issues, but will send eight different numbers, including Nos. 2 and 4 of Vol. IV, for twenty cents. The supply is limited; order early. We have secured some copies of Vol. I, No. 1. Those whose files lack this number may have a copy for a two-cent stamp.

—The *Bulletin of the Torrey Botanical Club* for November, 1897, contains an account of a new *Gymnogramme* from Venezuela, with remarks on some other Venezuelan ferns, by B. D. Gilbert. The new species was collected last Spring by Dr. H. H. Rusby, and Mr. R. W. Squires, and was found climbing on tree trunks in the deep forests about Santa Catalina. Mr. Gilbert names it *G. heterophlebia*, and remarks that its nearest relative is probably *G. membranacea* of the Malay and Phillipine Islands. Although there is a rather close resemblance between them the species are distinct. A curious fact in this connection is that while the genus *Gymnogramme* occurs in both the Eastern and Western hemispheres, no single species is known to be common to both.

—We have been unable to fill several orders for back numbers of the BULLETIN through lack of No. 1, Vol. iv. We will pay any reasonable price for a few copies of this issue. If you have a copy to spare, kindly let us know the price at once.

—The announcement is made that a new scientific magazine to be known as the *Natural Science Journal*, will make its appearance this month from New Bedford, Mass. There are to be seven departments devoted to the Natural Sciences, each with its own editor. Mr. F. G. Hillman, of New Bedford, will act as managing editor.

—The newly issued "Ferns and Fern Allies of New England," by Raynal Dodge, is a book unique in many respects. In upwards of sixty pages the ferns and allied plants of New England are clearly described in scientific language making it easy for anyone with this book in hand to identify all the species with certainty. The species are numbered according to the "Fern List," and Mr. Davenport's new fern, *Dryopteris cristata marginalis*, is here given a place for the first time. Special attention has been given to that perplexing group, the Quillworts, with the result that two species new to science have been added. In the chapter entitled "Remarks on the Genus *Isoetes*," much valuable information on the collection and identification of these plants is given. The book ends with a chronological list of the species, in which they are catalogued by their time of fruiting, making it easy for the collector to ascertain what plants are fit to collect on any particular day. The book is 16-mo in size, just suitable to go in one's pocket, and may well accompany the fern lover on his excursions. It is published by Willard N. Clute & Co., Binghamton, N. Y.; cloth, 50c.; paper, 35c.

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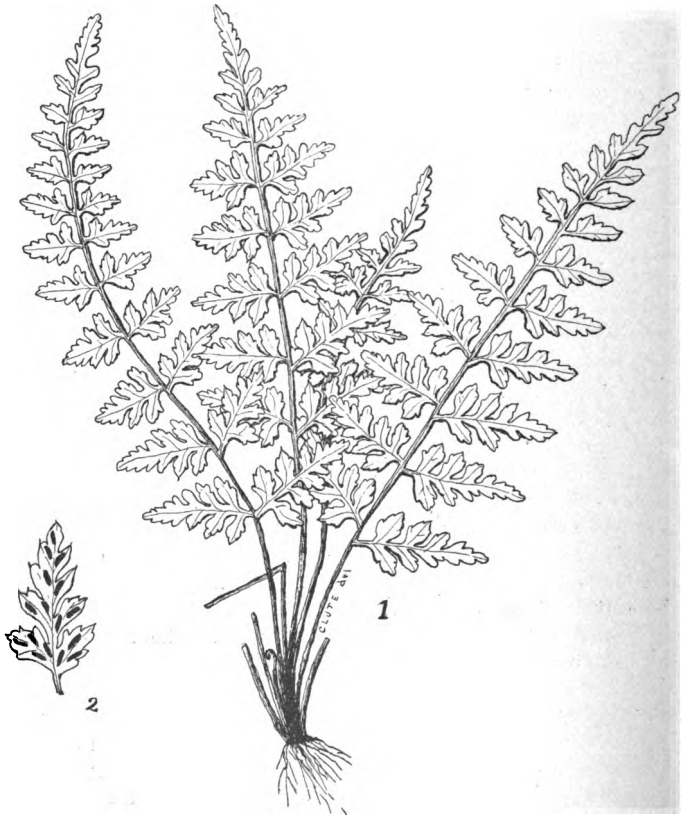
ASPLENIUM BRADLEYI.

BY C. E. WATERS.

THE entire coast-line of the Chesapeake Bay is very irregular, giving rise to numerous tidewater estuaries and inlets, which in this region are called "rivers" or "creeks," according to their size. The streams proper are occasionally called "creeks" also, but more often "runs" or "branches," or by the familiar designation of "falls." The Patapsco river, on which Baltimore is situated, has escaped these diminutives and is called a river. Along most of its course it has carved out for itself through granite and gneiss and schist a deep valley, which is considered a splendid example of "gorge erosion" by our local geologists. But the botanists know it also, and the four-mile walk down the river from Ilchester to Relay is a favorite one for an all-day trip. Ferns and flowering plants abound in summer, while at other times of the year hepatics, mosses and fungi are very plentiful.

Mr. J. H. Brummell, one of my fortunate friends who is continually coming across rarities, visited this region in the fall of 1893 and found on a couple of huge rocky walls close by the roadside a fine lot of the rare fern, *Asplenium Bradleyi*. On visiting the locality the next spring, my search was successful beyond my expectations, for growing with the *A. Bradleyi* was another fern that had eluded me for years—*A. montanum*. The two species were growing side by side, and the latter would hardly have been overlooked by Mr. Brummell had it not resembled very closely undeveloped *A. Bradleyi*. That this was not the case was shown conclusively by an examination of the stems. In *A. montanum* the stipe is brown only at the base, and the upper part of the stipe and the entire rachis are flattened, with two parallel grooves in front. In *A. Bradleyi* the entire stipe and the lower part of the rachis are brown, while in place of the two grooves we have

a single distinct one with a slight ridge running down its center. The similarity between the two species is at times so great that it requires close observation to distinguish them. In a small glass fernery in my room is a plant that until very recently, in fact until the preceding paragraph was written, I had taken for *A. montanum*, but which is undoubtedly *A. Bradleyi*. This particular plant, with one of its companion species, was transplanted to a rock about ten miles away from its original home, and after several months was again removed to my fernery. The other



ASPENIUM BRADLEYI.

FIG. 1.—Plant one-half natural size. FIG. 2.—Fruiting pinna.

plant died, but of course no conclusion as to the relative hardness of the two species can be drawn from this one instance. All the other ferns growing with this plant—*Cheilanthes lanosa*, *Pellaea atropurpurea*, *P. hastata*, *Dryopteris acrostichoides*, etc., have bent over towards the window in order to get as much light as possible. but the *Asplenium* has adopted an entirely different plan. Its fronds are spread out so that their upper surfaces are perpendicular to the brightest rays of light. It is very interesting to see the largest frond growing back from the window at an angle of about forty-five degrees

Asplenium Bradleyi was first found in Tennessee, by Prof. F. H. Bradley, where it was growing with *A. ebenum*, *A. pinatifidum* and *A. montanum* on sandstone. It has since been discovered in Kentucky, Arkansas, New York, Pennsylvania and Maryland. At the Patapsco river it is found on gneiss. Some of the best plants were growing in the cracks of a huge rocky wall that was exposed to the sun from mid-day until sunset. Yet on August 6th of last year, after a long drought, they were perfectly fresh and green, and the spores were just ripening. Some heavily fruited fronds were moistened and kept in the vasculum until the next evening, when on exposing them to the air the sporangia dried and opened in such rapid succession that a slight crackling noise could be heard when the fronds were held up to the ear. Unlike very many plants that grow in such exposed situations this fern has no scales or hairs covering the fronds, such as we find in *Cheilanthes lanosa*; nor is there any great development of the so-called "palisade tissue" of the leaf. The cuticle is very well developed however, and it is no doubt owing to this that the plant is enabled to resist long periods of dry weather.

Prof. Eaton suggested in his "Ferns of North America" that if there were a hybrid between *A. ebenum* and *A. montanum* it would probably closely resemble *A. Bradleyi*. It would lead us too far to discuss this question of hybridity at present, especially as no one now considers *A. Bradleyi* as a hybrid. Some of the arguments in Prof. Murrill's article in the January BULLETIN on *A. ebenoides*, might be advanced here. It is, however, interesting to note that the stem of this fern is a sort of intermediate between its two closest allies. *A. ebenum* has a brown stipe and rachis, the latter grooved in front; the stipe is not grooved, or noticeably flattened. The stems of the other two species have already been spoken of.

WIND-BLOWN FERNERIES.

IMMEDIATELY back of my house rises an abrupt, but somewhat broken ledge, facing south, in the crevices of which I counted last season twenty three plants of *Asplenium trichomanes*, a fern that is exceedingly rare in this vicinity. When we came here to live in 1875 there was not a fern growing on this ledge, and the only two plants of *Trichomanes* that I ever found within a mile, or more, of our home disappeared suddenly—probably being taken by some eager collector who chanced to discover their hiding place in the deep woods—long before the specimens made their appearance on my own ledge.

At first only a tiny plant was discovered in one of the pockets of the ledge, and this plant developed and grew without companionship for three or four years, when gradually other plants made their appearance and continued to increase until the present number was reached. If this increase continues as it has during the past five years, this ledge promises to become a prolific abiding-place for this lovely fern, and I shall have the pleasure of knowing that it will be under my own control and guardianship.

Two plants of *Asplenium ebeneum* and *Woodsia obtusa* have also made their appearance here. The former grew sparingly along the natural extension of the ledge not far away, but of the latter, a half dozen plants three-fourths of a mile away, are all I have ever seen within two miles of my residence. Now these ferns have made their new home with me spontaneously, and have done so in no other way than through the agency of wind blown spores lodging in the crevices of the rocks.

Some years ago my attention was called to the presence of several species of ferns growing in the chinks of the wall on the north side of the State prison in Charlestown, by Mr. C. E. Perkins, of Somerville (a very promising young botanist who has since died). At that time the prison was not in use, and taking advantage of its accessibility I made an investigation, which resulted in finding not only such ferns as *Aspidium spinulosum*, *Asplenium filix-femina*, *Dicksonia* and *Cystopteris fragilis*, but some others, and quite a variety of flowering plants, mosses, lichens and liverworts, all of which had apparently originated from wind-blown pollen and spores lodging in the damp joints of the granite wall.

In June, 1878, Mr. E. S. Wheeler found in Berlin, Mass., *Botrychium simplex* growing in the sandy soil of an unfenced

cemetery on a flat upland situated in the direct line of the valley coming down from the mountainous region to the west, and when later I visited the locality with Mr. Wheeler, it seemed to me that the presence of the plant in so strange a place was to be accounted for through the agency of wind-blown spores from the higher regions above. Other instances might be cited, and no doubt similar instances will suggest themselves to others, to show that oftentimes new stations for rare or common plants originate in this way, but this will suffice for the present.—*Geo. E. Davenport, Medford, Mass.*

A NEW QUILLWORT FROM MEXICO.

IN March, 1895, I received from Mr. C. G. Pringle a lot of *Isoetes*, one specimen of which, labelled *Mexicana*, proves distinct not only from that, but from all other described species. As it was collected in the State of Mexico, Mex., the ancient seat of empire of the Aztecs, the only North American people who possessed an organized government and were at all advanced in civilization, I deem it not inappropriate to name it *I. Montezumæ*, the *Isoetes* of the Montezumas.

ISOETES MONTEZUMÆ n. sp. Terrestrial, polygamous, with the aspect of *I. Butleri*; *trunk*, very deeply bilobed, 10–15 mm broad and high, the dead cortical layer persistent; *leaves*, 15–20, 8–14 cm high, very stiff, slender, erect, triangular, 1 mm wide and .8 deep in the middle, with four stout bast-bundles and many stomata; *dissepiments*, thick, 6–12 cells wide; *sheaths*, hard, light-colored, rough on the back, 3 mm across the base, lower part usually turning black and persisting as a small scale; *wings*, 1 mm wide, disappearing at surface of the ground; *velum*, very narrow in the female, absent but edges of cavity sharp in the male; *labium* usually produced and covering fovea; *sporangia*, 5 mm x 3 mm with a few scattered brown spots; *macrospores*, 350–460 μ , rather sparsely beset with low, blunt tubercles, naked for about 8 μ from the equator; the tubercles are often elevated into spinules, and are sometimes retuse; the equator is wide, thin and fragile, the commissures lower and thicker; *microspores*, ashy, very large and rotund, often as broad as long, averaging 40 x 35 μ , varying in length from 35 μ to 48.4 μ , densely tuberculate or spinulose.

Habitat: Damp soil; plains near Flor de Maria, State of Mexico. (C. G. Pringle, 1890. No. 3459.)

Placed beside *I. Nuttalli*, *I. Butleri* and the European *I. Hystrix*, this could not be separated save by a more or less close examination. Its persistent leaf-bases, though small, and its horny, scale-like leaf rudiments, found between the annual cycles of growth, connect the American with the European terrestrial species. This group is quite marked, and has, indeed, been separated as a different genus.

I. Montezumæ differs from *I. Mexicana* Undw., with which it was at first confounded, by its fewer, shorter leaves, spotted sporangia, shorter ligula, persistent leaf-bases, larger and more prominently tubercled macrospores, and larger spinulose microspores—the largest yet observed in the genus. (I have seen *I. Mexicana* only from immature, doubtfully typical specimens from lower California. My comparison is made with Underwood's description in *Bot. Gaz.* XIII, 4.)

From *I. Butleri*, its nearest congener, *I. Montezumæ* differs in having a narrower wing, smaller more prominently marked macrospores, more densely spinulose microspores, more slender and attenuate leaves, persistent cortex and leaf-bases. Of nine specimens, three are wholly male; among the remaining six, I found one with two microsporangia mixed in with macrosporangia, and there were microspores in the old cortex, indicating an alternation of generations, as is sometimes the case with European terrestrial species.—*A. A. Eaton, Seabrook, N. H.*

ASPLENIUM MONTANUM.

THIS little evergreen fern is found in considerable abundance on the shaded limestone cliffs and outcroppings upon the steep, wooded hills which line the lower Susquehanna river, in York and Lancaster counties in Pennsylvania. It loves to grow in the crevices of rocks and along ledges, often rooted deep in the horizontal chinks, so that only the upper part of the frond shows, protuding like so many green tongue-tips from half open jaws. The color is a rather dingy green, which makes the plant somewhat difficult to detect against the gray back-ground of the rock. The fronds, which are often quite numerous from one bunch of roots, have a reclining habit, according to my observation, even when growing on the surface of the rock. Speci-

mens collected in October last, at the locality above mentioned, showed many forking fronds, and in some instances the rhizomatous character of the plant first noted, I believe, with respect to this fern, by Thomas Meehan, though generally the plant grows in tufts, and is so described in books.



ASPENIUM MONTANUM.

FIG. 1.—Plant one-half natural size. FIG. 2.—Fruiting pinna.

A. montanum is a genuine American, and its habitat is limited, so far as reported, to the eastern half of the United States, (Arkansas included). It seems to have been first discovered by Michaux early in this century in the mountains of Carolina, where, according to Britton & Brown's *New Illustrated Flora*, it ascends to 4,500 feet above the sea. In the lower Susquehanna

region, the fern is not only found far up upon the precipitous hillsides, but also grows on the rocks down in the bottom lands amid debris brought down by the floods which are often so disastrous on this river in the spring. Specimens so labelled, recently collected by Joseph Crawford, are in the herbarium of the Philadelphia Academy of Natural Sciences. These plants, however, are quite small, some of them only an inch or so high, but apparently healthy and well-fruited.—*C. F. Saunders, Philadelphia.*

THE VARIETIES OF BOTRYCHIUM TERNATUM.

IT is particularly desirable at this time to have special attention given to the various forms or varieties of the so-called *Botrychium ternatum*, and that full notes be made of the habitat, time of fruiting and local variation of this species or group of species. It is by no means certain that any of the American forms of *Botrychium* are the same as the original *Osmunda ternata* of Thunberg, which was described from Japan. Out of the group of forms which Milde in his monograph (1869) included under *B. ternatum*, Prantl in his revision (1884) makes eight species, of which three are found in North America. One of these, recently figured in the *Botanical Gazette*, I believe to be entirely worthy of specific rank. Its period of maturing spores (early spring), added to its structural characters, render it a very distinct species. I wish to investigate thoroughly the remaining forms and determine, if possible, their proper rank, and would invite the readers of the FERN BULLETIN to send notes and specimens showing the range of variation in their various localities. If in any locality the species grows both in dry pastures or meadows and also in low shaded ground, I would like specimens from each station, carefully noting date when spores are first matured, relative abundance, and any other data of interest; particularly I would like specimens of the so-called variety *dissectum*, which Sprengel described as a distinct species. I find, for instance, that the plant, passing under that name, which grows in the low woods in the vicinity of New York, is entirely different from the forms with which I have always been familiar from Central New York and New England, which grow in dry, unploughed pastures or along neglected headlands, mostly in the open sunlight. In case two forms grow in the same vicinity, I would like specimens of each.

It is only with an abundance of material and field notes that any valid conclusions can be reached, and the readers of the FERN BULLETIN can render an excellent service in bringing this material together.—*L. M. Underwood, New York City*

GET IT IN YOUR EYE.

IT is a curious fact that things are more easily discovered a second time than the first. I suppose this is owing to an involuntary mental noting of the peculiarities of the locality. For instance, I found *Ophioglossum vulgatum* in a meadow with *Habenaria lacera* and a small *panicum* last July. It was scarcely as tall as the grass and the discovery was partially accidental. I afterwards found it in three other localities, two when not looking specially for it. I must have passed over this many times as it was within a stone's throw of my garden. The last locality attracted my attention from the road by the amount of *Sporobolus serotinus* growing there. It was in early September. I crossed a cranberry bog and found about an acre literally covered with *Ophioglossum*.

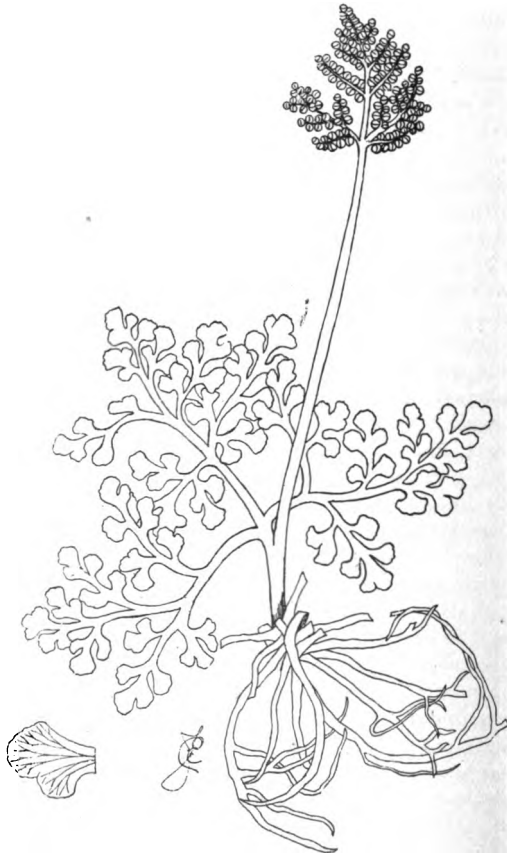
Lycopodium inundatum may be found among the same grass with *Viola lanceolata*. I have repeatedly found it by seeing the "call" plants and hunting for it. The variety *Bigelovii* grows best in cranberry bogs; in fact, the type locality at Chebacco Lake, Essex, Mass., is a cranberry bog, with considerable sphagnum in it. This so-called variety is merely a luxuriant form of the type. In looking for *Isoetes*, a muddy bottom is a sign of *I. echinospora Braunii*; sand of *I. e. Boottii* and *I. Tuckermanni*. The peculiar reddish-purple color of the latter, with its leaves in an ascending spiral, distinguishes it immediately. *I. Engelmanni* grows in shallow brooks in clay. *Woodwardia Virginica* is likely to be found in deep peat near a swamp; I found my first last year, and now know seven localities, one beside a road within half a mile of home. *W. areolata* often grows near the latter, but I have never found it mixed. *Dryopteris simulata* grows in its utmost luxuriance—often three feet high—amongst areolata.

If you have hunted for a plant and despaired of finding it, go, if possible, to a locality where it grows and see it growing, and try again. I have found many rarities by noting the "call" plants while riding by on a bicycle.—*Alvah A. Eaton, Seabrook, N. H.*

BOTRYCHIUM BITERNATUM.

THROUGH the courtesy of the *Botanical Gazette*, we are able to present herewith an illustration of the fern which Dr.

L. M. Underwood has recently given specific rank as *Botrychium biternatum*. The plant itself is not a new one, having been known since 1797, but until the present it has been confused with the varieties of *B ternatum*. The plant is described



BOTRYCHIUM BITERNATUM (Lam.) Underw.

in the *Botanical Gazette* for November, 1896, as follows: "Sporophyte with fleshy roots from which rises a short common stalk 1.5^{cm} or less high, bearing a nearly sessile, broadly triangular, ternately compound leaf 8 to 10 ^{cm} wide, 5 ^{cm} long; middle division slightly larger than the lateral ones and like them nearly bipinnate; ultimate divisions somewhat innate, usually not exceeding 5 to 6 ^{mm} in width, the outer margin crenulate, the lateral margins decurrent into the short branches of the rachis: sporophyll on a rather stout slightly elongate stalk (8 ^{cm} or more long), bipinnate, with a rather broad rachis: spores pale alutaceous, 39 to 44 μ in diameter: bud for the succeeding year enclosed in the base of the common stalk, smooth, the segments erect or with the apices barely incurved. Spores maturing in early spring (February or March in the latitude of southern and central Alabama)." It is remarkable that this species which fruits early in the season should have been so long confounded with *B. ternatum* since the latter is found in the same localities and does not fruit before August. The writer further says: "The species is readily distinguished from *B. ternatum* by its nearly sessile and more compound sterile leaf, as well as by the form of its ultimate divisions which are distinctly rounded and short, lacking the characteristic long, more or less pointed form, common to that species."

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Items for this department should be sent to Mr. C. E. Waters, Johns Hopkins University, Baltimore, Md.

—Some misunderstanding has arisen regarding the statement in the January BULLETIN that a copy of Dodge's "Ferns and Fern Allies of New England" would be sent to members of the Chapter. It was not intended to offer this as an inducement for others to join, but was simply for those loyal members who have stood by the Chapter when it needed assistance. We could not in any event give new associate members a subscription to this journal and the book for fifty cents. It has been decided, how-

ever, that all who join as active members, and date their membership from the beginning of the year, shall be sent a copy of the book free.—C

—The following new members have been gained by the Chapter since the January BULLETIN was issued; we welcome them all to our ranks: Active—C. H. Bissell, Southington, Conn.; J. M. Dickson, Hamilton, Ontario, Canada; Miss Mary A. Fleming, 18 West Chippewa st., Buffalo, N. Y.; Miss Edna L. Luttrell, Staunton, Va.; F. O. Carpenter, 25 Montview st., West Roxbury, Mass.; Miss Catherine M. Bates, Bedford, Westchester county, N. Y. Associate—Dr. Julia Russell, Main st., Malden, Mass.; Miss Charlotte N. S. Horner, Georgetown, Mass.; William M. Canby, Wilmington, Del.; Miss Gertrude Bedell, Squarctop, Pa.; C. C. Kingman, Reading, Mass. We now have 48 active and 24 associate members, a total of 72 in all, and it is not too much to hope that the end of the year will find more than a hundred names on our roll.—C.

The Chapter Ferns.

More than seventy-five packets of ferns were made up last December and offered to the Chapter in January. In less than two weeks requests for the entire number had been received and others came too late to secure any. This is all the more remarkable because of the fact that a large number of our members have collections so extensive that they seldom ask for specimens, and shows how eager our younger members are to add new species to their collections. This quarter we are offered a fern that many older students do not possess—*Dryopteris simulata*. This is the gift of Mr. C. E. Waters, who finds it plentiful near Baltimore, Md. Mr. Waters was one of the first to find this fern outside of New England.

During the year 1897, some changes in the distribution of the Chapter ferns will be made. But one species of fern will be sent out in each packet, and the packets will be mailed by the one who offers the fern. Members who wish a specimen of the fern offered this quarter will receive it by sending six cents in stamps to C. E. Waters, Johns Hopkins University, Baltimore, Md. Those who have sent ferns for distribution within a year may have a specimen by requesting it on a postal card. Those who can help less fortunate members by offering a species of fern for distribution later in the season are requested to communicate with President Waters.—C.

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THE fault is not ours that the FERN BULLETIN begins each volume without having complete sets of the preceding volume on hand. At present a few odd numbers of various issues are all that we have to offer. We have endeavored to retain enough copies of each issue to supply the subsequent demand for them, and each time we have under-estimated it. There are now less than fifty copies of the January, 1897, issue on hand, and those who would have their file of Volume V complete should order at once. We cannot supply any complete volumes of the BULLETIN, but we will undertake to pick up any missing numbers our subscribers may desire, if we are notified at once. The charge for this will be five cents per copy. It is probable that the July issue will find this journal without a back number on hand.

* *

THE articles upon the genus *Equisetum* which Mr. Alvah A. Eaton is preparing for this journal, will be increased in value by a unique plan for illustrating the series. At the time when each is published, sets of the specimens treated will be made up and sent to subscribers to this journal, or members of the fern Chapter who desire them, for about the cost of postage. As Mr. Eaton contemplates studies of all the North American species, and their numerous varieties, the value of the specimens to students in connection with the notes upon them is not to be lightly estimated. Information of any kind relating to *Equisetum* will be welcomed, and may be addressed to Mr. Eaton, or to the editor of this journal.

A SECOND glance at the illustration of *Asplenium montanum* in this number will show a great difference in the shape of the fronds. The three fronds did not grow on one plant, but they do belong to one species. They are here figured side by side in order to give some idea of the variation of which this fern is capable.

* *

THE notes on *Botrychium biternatum* in this number afford a text from which a pertinent sermon might be preached to botanists upon the value of keeping one's eyes open and thinking about what he sees. As *Botrychium ternatum lunarioides*, this fern has long been known, but no one looked at it close enough to see that it was a distinct species. Even now its exact range is not known, and those who have specimens of this so-called variety would do well to examine them with a view of throwing light upon the subject. When we come to a closer study of our ferns we shall doubtless find that we have overlooked many interesting facts in the history of our common species

* *

A GREAT deal of confusion exists among botanists because of the ambiguous use of the term frond. To one the word may mean simply the expanded leafy portion of a fern, while to another it may also include the stalk or stipe. It is certainly desirable that some uniformity be attempted in the use of the term. Mr. Geo. E. Davenport has recently suggested in the *Botanical Gazette* that the word *frond* be used to designate the combined blade and stalk, the blade itself being called the *lamina*, and the stalk the *stipe*. This use of the term has been adopted in Dodge's "Ferns and Fern Allies of New England," and will be followed as much as possible in the pages of this journal. The tendency at present among botanists is to drop the word frond entirely, using in its stead the word, leaf. Fern lovers, however, will be loath to make this change. The idea conveyed by the word, frond, is so appropriate, and its use in literature has been so wide-spread, that it is unlikely that any except the most matter-of-fact botanists will long favor the change

Although the text books are silent regarding the anastomosing of the veins of *Asplenium ebenoides*, several observations of this character have been put on record. This is true of the specimens collected in the State of New York in most of which the areolate structure of the veins is well shown.

NOTES.

—In the *Botanical Gazette* for February, 1897, Mr. L. F. Henderson describes a new species of *Isoetes* from Idaho, which he dedicates to Dr. L. M. Underwood.

—The *Observer* of Portland, Conn., has returned to the field from which it retired last October. The numbers lacking for 1896 have been printed and the journal starts the new year with fair prospects of success.

—Under the title "Among the Ferns," Mr. C. F. Saunders has contributed to the March number of *Godey's Magazine* a charming sketch of several of our native ferns. Eight fine illustrations by Miss Elizabeth M. Hallowell add interest to the article.

—On Feb. 5th and 6th, 1897, a very successful meeting of botanists was held at Burlington, Vt., the occasion being the second annual meeting of the Vermont Botanical Club. About twenty botanical papers were read. The Club will also hold a "field meeting" in July. The organization contains sixty members and cordially invites all botanists in the State of Vermont to join. The secretary, Prof. L. R. Jones, Burlington, Vt., will be glad to answer any inquiries about membership, etc.

—A new Quillwort is described and figured in the *Botanical Gazette* for January, 1897, by Mr. Raynal Dodge. It has been named *Isoetes Eatoni*, in honor of the discoverer, Mr. Alvah A. Eaton. The plant in question is peculiar in being the largest species known to North America. The trunk is sometimes two and three-fourths inches in diameter, with leaves twenty inches or more in length. Some investigations into the chemical nature of the clear white covering of the macrospores of this species lead the writer to conclude that it is mainly silica.

—Considerable interest attaches to a paper by Prof. Edward C. Jeffrey on "The Gametophyte of *Botrychium Virginianum*," published in the Proceedings of the Canadian Institute for 1896, from the fact that our knowledge of this phase of the plant has until recently been very meagre. The prothallium of *Botrychium* is subterranean and the difficulty of finding it has hitherto prevented anything like a complete study. In 1895 Prof. Jeffrey discovered several hundred prothallia on the margin of a peat bog; with this material in hand a knowledge of all the lacking stages in the development of the young sporophyte has been supplied.

—*Garden and Forest* for November, 1896, contains an article on *Dryopteris simulata*, by Mr. George E. Davenport, with a full-page plate of the fern drawn by Mr. C. E. Faxon.

—The initial number of the *National Science Journal* has just been issued at New Bedford, Mass. This publication starts with a very creditable appearance and contains articles on entomology, botany, mineralogy, anthropology, conchology, etc. Each number is to contain twenty-four pages. An article on "Fern Spores" appears in the current number.

—"The Transformation of Sporophyllary to Vegetative Organs," by Prof. Geo. F. Atkinson, has been received from the author. This is reprinted from Biological Lectures delivered at Woods Holl in 1895, and details Prof. Atkinson's experiments with *Onoclea sensibilis* and *O. Struthiopteris* with reference to changing fertile fronds to vegetative organs by cutting off the sterile fronds. It is proved that the intermediate fronds occasionally found on these species may be produced at will by removing the sterile fronds early in the season. Eight plates, showing the more striking forms developed, are included.

—A most important contribution to the literature of American botany has recently appeared in the shape of the first volume of "An Illustrated Flora of the Northern United States and Canada," by Dr. N. L. Britton and Hon. Addison Brown. The authors of this work have attempted the great task of representing every species in the territory covered, by accurate drawings, and have also added concise and full descriptions for their identification. Other points that make the work of value are the excellent Keys to the Genera and Species, the Synonymy of each species and the common names that are given. The nomenclature is also brought up to date. The present volume contains 625 Royal octavo pages with 1425 illustrations. Among the families included are the ferns, conifers, sedges, rushes, grasses, orchids, lilies, willows, pond-weeds, etc. Two more volumes of like size will be issued sometime this year, completing the work. Some idea of the estimation in which this work is held by botanists may be gleaned from the fact that in less than six months nearly two thousand copies have been sold. We can supply the first volume, bound in cloth, for \$3.25, and will give a year's subscription to the FERN BULLETIN with every order. Those who are now subscribers may have their time extended one year with each order. Address the editor of this journal.

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THE FERN BULLETIN.

VOL. V.

JULY, 1897.

NO. 3.

JAMAICA, THE FERN-LOVER'S PARADISE.*

By B. D. GILBERT.

THE island of Jamaica has long been known among botanists as especially prolific in ferns. From the time of Sir Hans Sloane, who went to Jamaica as early as 1687, and whose library and natural history collections, including the plants of the island, formed the foundation of the British Museum, down to the present time, the known number of fern species in Jamaica has continually increased and is still increasing to-day. Olaf Swartz, the Swedish pteridologist, who first put the study of ferns on a scientific basis, visited Jamaica in 1783-6, and his well-known work, the "Species Filicum," published in 1806, was founded largely on the ferns gathered in that island and in the other islands of the West Indies.

Since the time of Swartz, at least a dozen botanists have made a specialty of collecting ferns in Jamaica. The most complete catalogue published down to 1864 was the one given by Griesbach in his "Flora of the British West Indies." His list credited three hundred species to the island. But since the publication of Griesbach's flora, such enthusiasts as Wilson, Nock, Sherring and Jenman have scoured the Blue mountains in search of fern novelties, and have not only discovered scores of species already known in Cuba or on the South American continent, but have added many new species not previously collected elsewhere. There is no doubt in my mind that no other area of land in the world, of the same extent, produces one-half the number of fern species and varieties that grow in Jamaica. Well may we call it the fern-lover's paradise.

*From a paper read before the Torrey Botanical Club, Mar. 9, 1897.

There are good reasons for this exceeding richness of the fern flora in Jamaica. The island lies between 17° 43' and 18° 32' north latitude, the northern limit being more than five degrees south of the Tropic of Cancer, and the southern shore more than six degrees south of the same Tropic. The Blue mountain range in the eastern extremity of the island rises from 6,000 to 7,000 ft. above sea level, and Blue Mt. peak towers to the height of 7,360 ft., or nearly a mile and a half perpendicular in the air. The southern shore of the island, besides lying fifty miles farther south than the northern, is sheltered by these lofty ranges of mountains from cooler breezes, and at some points is said to be as torrid in climate as Barbadoes or Trinidad. In fact, Kingston, the capital, has the reputation of being one of the hottest places in the West Indies. Thus the climate ranges from the extreme heat of the tropics on the southern shore, to the cool temperature of the northern temperate zone on the mountain tops; while the various gradations between these are found as one travels from the level of the coast to the higher altitudes of the mountains. In addition to this variation in temperature, there is a great variation in moisture. On the Liguanea plain, which extends six or seven miles inland from Kingston and is somewhere near fourteen miles long from east to west, rain does not fall more than two or three times during the six months of the dry season; but the mountains are famous for attracting the clouds, so that rain falls there all the year around and nearly every day, often in deluges of water. Moisture and heat therefore, which are prime requisites for the growth of ferns, are here in abundance; while on the mountain summits a much colder temperature prevails, and gives a wonderful variety to the climate. This is evidenced by the fact that *Cystopteris fragilis*, which is a cold temperate species, and has even been found as far north as Iceland, and *Dryopteris filix-mas*, which grows throughout northern Europe, in Greenland, and at an elevation of 15,000 ft. in the Himalayas, have recently been discovered on Blue Mt. peak, the only known habitat of these species in the West Indies.

The Blue mountains proper is the place to see the tree ferns growing in perfection. Jenman states that the trees of *Cyathea arborea* form unmixed groves, "while the stems constitute the only wood used or easily procurable in certain districts as posts in the houses of the peasantry." This species reaches the height of thirty feet; while *C. pubescens* often attains a height of forty feet. The tallest fern of the island, however, is *Alsophila armata*,

which frequently occurs thirty to fifty feet high, although the stem is very slender, being only two to four inches in diameter. Probably the stoutest trunk is that of *Hemitelia horrida*, which, although not more than eight to twelve feet high, is often six to ten inches in diameter. *Cyathea pubescens* also becomes very large in girth by sending out aerial rootlets, which form a matted growth over the original stem of the tree. I have seen trees thus covered which it would not be easy to reach around with one's arms, and the whole circumference is sometimes draped with the shining green of masses of filmy ferns, especially *Trichomanes trichodeum*, and *Hymenophyllum asplenoides*.

Now let me give you some idea of what may be seen in a stroll along a country road in Jamaica. These roads are as hard and smooth and fine as you will find anywhere in England. Always they are bordered with stone walls on either side, while between the road and the wall there intervenes a strip of green from two to six feet in width. These walls are the nestling places of the common ferns of the particular region where they are situated. The grassy border of the road frequently has its quota of ferns also, but these are generally of larger size. In the eastern part of the island the commonest roadside fern is *Blechnum occidentale*. In the central and western parts its place is taken by *Polypodium reptans*, which has half a dozen different forms and tempts one to gather it notwithstanding one knows perfectly well what it will prove to be. Here it is a creeping plant with round-lobed or hastate pinnæ; there it grows upright, as a self-respecting fern should; here it is long and narrow, there it is quite broad and resembles a true *Nephrodium*. Indeed, pteridologists are at variance as to whether it is a *Polypodium* or a *Nephrodium*. After you have risen 1,000 or 1,500 feet above the sea, *Anemia adiantifolia* becomes a common roadside fern: and occasionally you will come upon a bank of *Gleichenia pectinata*. I saw one such bank or rock, which must have been thirty feet long by twenty feet high, completely covered with this trailing fern, bright green on one side and glaucous on the other. On the north coast and under the lee of shelving rocks there is always *Pteris longifolia* and some of the *Adianta*. *A. cristatum* and *A. striatum* both grow in dry and dusty places. In the central parishes *Dicksonia rubiginosa* stands up in the borders four to five feet high, and the large form of *Nephrodium cicutarium* is conspicuous. Or perhaps you come along to a boulder on the face of which clings the running rhizome of *Polypodium salicifolium*,

or *P. Swartzii*, or *P. vacciniæfolium*. Or possibly it may be a tree, up whose trunk and along whose branches one of these ferns is climbing, or which harbors in a cleft of its bark some pretty plants of *P. plumula*, or in the crotch of a branch a plant of *P. Phyllitidis*, with its long stiff leaves sticking up like a bunch of plumes. All these, you must remember, are the common things that meet your eyes every day without going out of the highway of travel; and they are varied with the sight of cocoanut groves and royal palms and coffee plantations and banana plantations, and everything that goes to make up a tropical landscape.

One of the most interesting features of the Jamaica fern flora is the large number of endemic species that are peculiar to that island alone. It would seem as if the work of differentiation had gone on there with greater activity and more vital power than in almost any other country in the world. There is not a genus of any importance in this Order which does not contain from one to a dozen species that are not found elsewhere. Nineteen genera of ferns in Jamaica possess endemic species; and one genus, *Enterosora*, with a single species, has been found only in one other locality, viz., on Mt. Roraima, British Guiana. This feature of Jamaica ferns renders the business of collecting there something more than a mere search for what has been gathered before by previous investigators. There is always the zest that comes from a possibility of procuring some species that is still new to science, as Wilson and Nock and Sherring and Jenman have done. The possibilities seem to be by no means exhausted; and I have no doubt that if what is known as "The Cockpit country"—comprising something like one hundred square miles—ever comes to be thoroughly explored and investigated, it will yield a substantial addition to the new species of the island.

BOTRYCHIUM TERNATUM SWZ., AND ITS VARIETIES.

THE notes on these plants in the April BULLETIN contain so much that is, by implication, misleading, that I am led to offer some comments in reply. One not well acquainted with the *Botrychiums* and their history, might very naturally infer from the statements made in the notes alluded to, that they had never received more than a superficial investigation, and that the whole genus was sadly in need of revision. With this view I can have no sympathy whatever, as it has no grounds to rest upon, exactly the contrary being true. I regret very much

indeed being placed in seeming antagonism to Dr. Underwood, who has done and is doing so much valuable work that I trust will live long after my own is forgotten, and for whom I entertain the strongest feelings of friendship, but fidelity to my own convictions compels me to dissent from his views and to place my own on record, as I believe that here, at least, he is wholly in the wrong.

The Botrychiums have always had for me a singular fascination, and I have neglected no opportunity to increase my knowledge of their characters during my more than twenty years' familiarity with them. Since 1873 innumerable specimens, in a great variety of forms, and from a wide range, have passed through my hands, so that I feel justified in claiming to have some knowledge of them and their relations to one another. I was the first in this country to publish an account of their spore* and bud† characters, and to call attention to Milde's masterly analysis.

Heretofore I have supposed that Lamarck's species (*Osmunda biternata*) had received a very careful consideration and its position properly determined, not from any superficial examination of which Milde was incapable, but from a thorough study of its structural characters and all available material, yet at last I learn through the medium of the notes alluded to, that "no one had looked at it close enough to see that it was a good species!" Pray then, why did Lamarck, and upon what grounds publish it? Why Michaux? No one questioned its specific rank until Milde's masterly analysis demonstrated its varietal character.

I have myself, in *Botanical Gazette* for April, submitted evidence enough to show that there are no structural characters of specific value, and that its early fruiting period is of varietal importance only. I have shown also that the bud is not smooth, as a rule, but pilose, and that the spores are exactly the same as in all of the other forms, including the European and Japan forms, and there is not a scintilla of new evidence to show that any character has been overlooked, or any not already known, and disposed of, brought forward. So that in my judgment, the resurrected claim for specific recognition cannot be maintained, nor is there any grounds for the assertions in the BULLETIN.

At the same time I hope the readers of the BULLETIN will respond generously to Dr. Underwood's request for notes and

*Notes on *B. Simplex*, Salem, 1877.

†Vernation in Botrychia, *Bull. Torr. Bot. Club*, Jan. 1878.

material, for I feel sure that the more material he has the stronger he will find the evidence against his present views to be. The species exhibits the most astonishing variations, and what is most remarkable is the duplication of these variations in the variety *dissectum*, specimens of which may be found showing the lunate segments of *lunarioides*, the oblique segments of *obliquum*, and the obtuse, or even rounded segments of the European forms of *ternatum* itself, with every possible degree of incision of the margins from the simplest dissection to the deepest lacinated divisions of the form *millefolium*.

Dr. Underwood has sent to me a portion of a frond from the New York form which he thinks is distinct from the New England forms of *dissectum*, but I find, as I expected, for I have long been familiar with it, that it is only a finely lacinated form of *dissectum*, which is frequently collected in New England and elsewhere. I have collected it many times, and received it from others, and there are specimens from Essex county, Mass., collected by John Robinson, in the Davenport Herbarium (Mass. Hort. Society) that match it exactly. *B. dissectum* Sprengel, was well disposed of by John Milde, who gave Sprengel's original description verbatim in the body of his own monograph. It connects *lunarioides* and *obliquum* with typical *ternatum* through innumerable intergrading variations, and the medium of its bud, spores and structural characters.

I have in *Botanical Gazette* (l. c.) alluded to one of Mrs. Barnes' North Woods (N. Y.) plants as resembling *lunarioides*, but I might have gone further. I have five specimens from Mrs. Barnes mounted on the same sheet with other specimens of *ternatum* that show a varying length of stalk to the sterile division, the longest being scarcely longer than in Chapman's Florida specimen of *lunarioides* in the Gray Herbarium, and with small, rounded segments, some of which are quite lunate in form. These plants if collected in Alabama would not be considered in any way distinct from *lunarioides*, but here, on account of their surroundings I have preferred to keep them with my series of *ternatum* forms, though I am not sure that I would not be justified in mounting them separately and labeling them *lunarioides*, as there is no difference whatever in their buds and spores. Milde mentioned seeing similar specimens from Lapland, and this shows the difficulty of attempting to separate the different varieties into distinct species.

Rev. Arthur W. Stanford, of Lowell, Mass., who has passed much time in Japan and collected largely of the ferns, tells me that he found *B. ternatum* frequent, but never noticed any difference between it and what he had collected about Amherst, Mass., when a student at the college there. The specimen which he has given to me represents the variety *obliquum*, with bud and spores as in our own forms. Milde records *rutaceum* and *Australe* as ordinary Japanese forms, and whether we take one or the other of these forms to represent Thunberg's type the result will be the same. The outline drawing of *B. ternatum* in the "Illustrated Flora" is a very good representation of *obliquum*.

Finally I do not believe that it is possible to maintain specific rank for any of the forms which Milde placed under *ternatum* without first disregarding altogether the intermediate forms, a course wholly against nature.—George E. Davenport, Medford, Mass.

A NEW CHEILANTHES OF THE SECTION ADIANTOPSIS.

IT was my fortune to be stationed at the Deer Park school-district, above Dunlap P. O., Fresno county, Calif., from Oct., 1890, to May, 1891. During this time, among other interesting things, I found a small fern which I at first, not having good authorities to consult, referred to *Pellaea densa*. Subsequently I placed it with *Cheilanthes Californica*, but doubtfully, owing to its small size and different outline. I sent a root east, and on my return in 1893 it was a fine plant, completely filling a four-inch pot, very densely set with fronds, which numbered several hundred. Having access to Eaton's "Ferns of North America," I was constrained to believe it a very odd form of *C. Californica*, if indeed it belonged there at all. I sent a few fronds to Prof. Eaton, who examined them and replied that by soaking out and pressing out flat they were seen to be a small form of *C. Californica*. This satisfied me until last winter when I received fine specimens of *Californica* from several localities in San Diego county. A most casual examination suffices to show that, though closely related, they are specifically distinct. *Californica* is nearly ternate through the great development of the lower pair of pinnæ, which are over half the length of the frond, the entire breadth usually equalling the length, while in the Fresno county plant the breadth is rarely .8 the length. *Californica* is deeply quadripinnatifid in the lower half, tripinnatifid in the upper ;

the other *tripinnatifid* in the lower part, *bipinnatifid* in the upper. The lower side of the inferior pinnæ of the first is excessively developed, the outline being nearly that of a right isosceles triangle, the base nearly perpendicular to the main stipe, the basal, inferior secondary divisions being about one-third the length of the whole lamina. In the other, the two sides of the inferior pinnæ are nearly equally developed, it being ovate or lance-ovate in outline; the basal secondary segments are only one-fifth to one fourth the length of the whole frond. The fronds of *Californica* sometimes exceed a foot in height, while the other attains habitually less than one-third this size. *Californica* is confined to southern California and Mexico; never, so far as I am aware, having been found in the Sierra Nevada Mts.; while this is found at the exact axis of the State, due east thirty miles from Fresno City.



CHEILANTHES AMCENA.

Fig. 1.—Frond natural size. Fig. 2.—A pinnule slightly enlarged. Fig. 3.—Pinnule of *C. Californica* enlarged.

CHEILANTHES AMCENA, n. sp., the Charming Lip-Fern. *Root-stocks*, densely tufted, chaffy; *stipes*, slender, chestnut brown, smooth, somewhat ridged or winged on sides, concave above, 3–7^{cm} long, crowded, erect; *fronds*, dark-green, 3–4.5^{cm} long 2–3.5^{cm} broad, *lance-ovate* in outline, the two lower pairs of pin-

nules *tripinnatifid*, the others *bipinnatifid*, the ultimate segments 1-4^{mm.} long, lanceolate, half as broad as long, with 3-6 clusters of sporangia, the tip abruptly acute, not recurved. It differs from *Californica* in its smaller size, darker color, denser habit, narrower, less divided fronds, the lower secondary divisions not unequally developed. The outline of *Californica* is nearly that of *Gymnogramme triangularis*, while *amœna* approximates *Pellæa dunsæ*, but is narrower, being almost exactly as *Notholaena dealbata* is represented in Eaton's "Ferns of North America." *Californica* is well represented in Eaton's work, as well as in Robinson's "Ferns in Their Homes and Ours." The light color might be thought to be unnatural, but I find that the shade is nearly correct. The ultimate segment represented by Eaton, however, is too broad and not sufficiently acuminate pointed. Probably the reason Prof. Eaton did not detect this as a new species was because the meagre specimens sent were plucked and sent in a letter, becoming disfigured thereby.

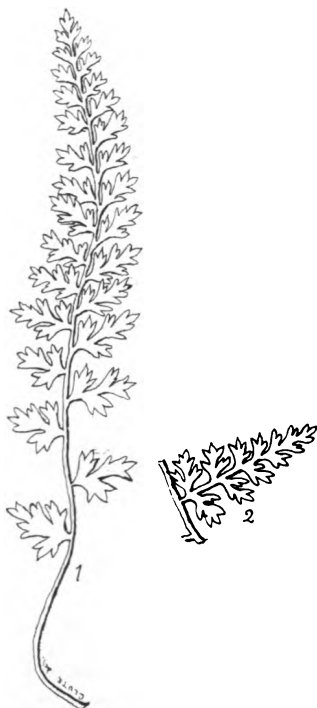
Amœna grows in disintegrated granite soil that is apparently impregnated with iron, preferably in the shade, but often in the sun, in crevices of rocks in the mountains just below Pine Ridge, in the belt of live oak chaparral, at perhaps 8,000 feet elevation, on the west slope of the Sierra Nevada Mts.—A. A. Eaton, *Seabrook, N. H.*

ASPENIUM FONTANUM.

PROBABLY the rarest fern in North America is *Asplenium fontanum*. It was first collected in this country in July, 1869, by Mr. J. M. McMinn, who found it growing on cliffs of limestone along Lycoming Creek in Lycoming county, Penna. Specimens were sent along with other plants to Dr. Thomas C. Porter, of Lafayette College, who, thinking the fern was collected in foreign lands, paid little attention to it, and it was not until 1890 that *Asplenium fontanum* was known to be a member of our fern-flora. In the interim Mr. McMinn died and with him died the knowledge of the fern's exact location.

As soon as it was known that *Asplenium fontanum* was really a native, search was made along the rocky banks of Lycoming Creek for more specimens, but all efforts to rediscover the fern there have thus far been unavailing. Since then, however, another locality for the plant has been discovered, also by Dr. Porter—but under circumstances that render the exact locality

as elusive as the other. The specimens referred to were distributed without name, along with other plants, by Dr. H. C. Beardslee, the label reading, "Springfield, Ohio, Mrs. E. J. Spence, collector." Specimens from both localities are preserved in the Herbarium of Columbia University, and do not differ in any particular from European specimens.



ASPLENium FONTANUM.

Fig. 1.—Frond natural size. Fig. 2.—Pinna of "A. Halleri" somewhat enlarged.

It is a curious fact, in connection with the discovery of this fern in America, that it has been reported many times from Great Britain but always with such uncertain data that fern-students there are still divided upon the subject of admitting it to their catalogues as a native species. It is not preposterous to

suppose that the fern may occur in other parts of America. In the Old World it is fairly common from France and Spain to Greece and the Himalaya mountains. Our illustration was made from a frond collected in France. The plant's general appearance is so much like *Cystopteris fragilis*, or some of the smaller *Aspleniums* and *Woodsias* that it might be easily overlooked, even by the fern hunter. There is also considerable difference in the fronds, so much so, that a tall form with slightly differing pinnæ has been described as a separate species, under the name of *A. Halleri*. It is now regarded, however, as a mere form of *fontanum*. A pinna of *Halleri* is also figured.

For the convenience of those who may wish to make a search for the plant along our limestone ledges, I include a description of it, taken from Dr. Underwood's "Our Native Ferns." "Stipes, one to three inches long, scaly at base; fronds three to six inches long, one half inch to one inch wide, tapering both ways from above the middle; pinnæ ten to fifteen pairs, their segments deeply dentate with spinulose teeth; sori, one or two on each segment." As will be seen from the illustration, to characterize the teeth of the segments as spinulose is perhaps too strong an expression, but as the fronds vary so much it is not improbable that specimens possessing this feature often occur.—Willard N. Clute.

OUR MISCELLANY.

In the original description of *Asplenium Bradleyi*, Eaton says: "In some of its more compound forms it is related to *A. montanum*, from which it differs in its larger size, more membranaceous texture, narrower outline of the fronds and shorter stalked pinnæ. Some of the denser specimens also resemble somewhat *A. lanceolatum* of Europe."

Those who are investigating the subject of forking fronds will be interested in the following note from Gerard's "Herball," published in 1597. It refers to *Ophioglossum vulgatum*, commonly called Adder's-tongue: "I have seene an other like the former in root, stalke and leafe; and differeth in that that this plant hath two and sometimes more crooked tooongs yet of the same fashion, which, if my judgment faile not, changeth *par accidens* even as we see children borne with two thombes, upon one hand. * * * * In gathering of twentie bushels of the leaves a man shall hardly find one of that fashion."

THE LINNÆAN FERN CHAPTER OF THE AGASSIZ ASSOCIATION.

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Fern lovers are cordially invited to join the Chapter. Active membership costs \$1.00 annually; Associate, 50c. This journal is sent to both classes free. Application for membership should be made to either President or Secretary.

Items for this department should be sent to Mr. C. E. Waters, Johns Hopkins University, Baltimore, Md.

—Secretary Alvah A. Eaton, of Seabrook, N. H., offers to collect and mail to any address a duplicate type herbarium specimen of *Isoetes Eatonii* for ten cents. Each specimen will consist of a plant in its spring dress of long leaves, and one in its summer dress of short leaves and ripe spores.—C.

—Mrs. Julia E. Campbell, Long Beach, Calif., offers a frond of *Cheilanthes Californica* to any member of the Chapter for 5 cts. in stamps. They were collected at Eaton's Canon, Pasadena, Calif. Those who are able to collect our rarer ferns may render a service to less fortunate members by having the free distribution of ferns in mind while collecting this summer, and adding a few specimens to their stock for this purpose.—W.

New Members.

Seventy-six fern students are now members of the Fern Chapter. One year ago, when our list of members was printed, it contained but forty-two names, which shows a gain during the past twelve months of thirty-four members. Those who have joined since the April BULLETIN was issued are nine in number—all active members. The list follows: A. J. Grout, Columbia University, New York; W. A. Bastedo, 121 W. 61st St., New York; H. S. Kitchel, South Bethlehem, Penna.; Miss Laura F. Kimball, National City, San Diego county, Calif.; Miss Mary E. Jones, 1811 Maryland Ave., Baltimore, Md.; Miss Elizabeth Hunger, 142 E. 18th St., New York; Miss Carolina M. Wood, Mt. Kisco, Westchester county, N. Y.; Miss Elizabeth Whittlesey, Morris, Ct.; Mrs. J. W. Humphrey, Woodstown, N. J. The many new members added to the Chapter will require a revised list of members to be issued in the near future. All who think of becoming members should join at once in order to appear in this list.

—THE—
FERN BULLETIN.

A QUARTERLY DEVOTED TO FERNS.

Official Organ of the Linnaean Fern Chapter.

WILLARD N. CLUTE, Editor.

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THE friends of this journal who have worked so earnestly for its success will doubtless be glad to know that it now has a circulation that places it abreast of the more prominent botanical publications. In accordance with this growth, arrangements have been made to add four pages to each issue of Volume VI. These pages will be devoted to the mosses, under the editorship of Dr. A. J. Grout. Notes or queries of general interest relating to this subject, may be directed to him in care of the editor of the BULLETIN.

* *

OUR thanks are due Mr. Charles T. Drury for a copy of his interesting volume, "Choice British Ferns." In this book a view of fern study is presented which is doubtless quite novel to American students. So little attention is given to fern "sports" on this side of the Atlantic, that a volume devoted almost wholly to an enumeration and description of such forms is both curious and interesting. More than three hundred different varieties of the British fern-flora are recorded, the Hart's-tongue (*Scolopendrium*) alone having upwards of sixty forms to its credit. The numerous branching, tufted, crested and lobed forms of the latter species are all the more remarkable from the fact that fronds of this fern are ordinarily lanceolate linear in outline with entire margins. Spores from these variable forms are capable of developing plants like the parent or even surpassing it in fantastic aberrations. The cultivation of these forms receives much attention in England, and our American readers would doubtless find considerable interest and amusement in assisting the tendency to variation in their own ferns.

ONE of the chief thorns in the young botanist's path to knowledge at present is the frequent changes in the names of plants. No sooner has he learned a set of perhaps, to him, meaningless scientific names, than he is obliged to supplant them with another lot equally unintelligible. Fortunate is he who can console himself in the task with the thought that in all this we are approaching a more stable nomenclature. Even the plants that have been known and studied for centuries have not escaped the general mutation. *Scolopendrium* has long been known as *S. officinarum* or *S. vulgare* and was but recently changed to *S. Scolopendrium* because of the discovery of an older name. Now the generic name is to have its turn. Prof. Edw. L. Greene finds that it is antedated by *Phyllitis* of Hill, and our plant accordingly becomes *Phyllitis Scolopendrium*.

* *

THE communication in this issue from Mr. Geo. E. Davenport regarding the varieties of *Botrychium ternatum* emphasizes the fact that the rank to be given these peculiar forms is still a matter of considerable doubt, and the decidedly different views upon the subject held by two of our foremost fern-students serve to indicate how far the question is from a satisfactory settlement. When such such botanists as Lamarck and Michaux have considered the so-called variety, *lunarioides*, distinct enough to be entitled to specific rank, we should not be too hasty in accepting Milde's dictum regarding its varietal nature, especially since he certainly had very little material from which to judge of its merits. The only satisfactory way in which the whole question can be disposed of is by the examination of a large amount of material from a wide range of territory. In this work every reader of the BULLETIN can assist by keeping a sharp lookout for all varying forms of *Botrychium*. A large number have responded to Dr. Underwood's request for specimens in the April BULLETIN, and it is hoped that others may do so. All forms of *dissectum* and *lunarioides* are especially desired, and may be addressed to the editor of this journal. Rare and peculiar forms will be returned after study, if desired.

—The October BULLETIN will contain a list of those nominated for office in the Chapter for 1898. The nominating committee, which consists of the present officers of the Chapter, will be glad to hear from any member who desires to suggest candidates for office.

NOTES.

—An article on The Bracken appears in *Popular Science News* for April.

—The March number of *Meehan's Monthly* contains a page article on the Harts-tongue fern, by Willard N. Clute.

—Mr. Geo. E. Davenport devotes several pages of the *Botanical Gazette* for April to the discussion of the rank to be assigned the so-called variety *lunarioides* of *Botrychium ternatum*. His conclusions are summed up in the suggestion that the plant had best remain where Milde placed it—as a good variety of *B. ternatum*.

—Another interesting volume* designed to assist the beginner in fern study has recently appeared from the press of Henry Holt & Co. The book is mainly a series of octavo plates, 72 in number, from drawings by the author, illustrating all the species of ferns to be found in the United States east of the Mississippi river and north of North Carolina and Tennessee. By its use one who knows nothing of botany, may identify any fern in the region mentioned, by simply turning over the pages until he comes to the illustration that matches his specimen. The pages are also interleaved with stubs to enable the collector to preserve specimens of each fern by fastening them to the blank pages. Students of botany in general will find this work of much value in identifying ferns.

—A second volume of "An Illustrated Flora of the Northern United States and Canada," by Dr. N. L. Britton and Hon. Addison Brown, has just appeared. In all respects it is the equal of the preceding one, and carries the subject from *Portulacaceæ* to *Menyanthaceæ*. Besides many smaller families this volume treats of the *Crowfoots*, *Cresses*, *Saxifrages*, *Roses*, *Legumes*, *Spurges*, *Sumacs*, *Mallows*, *Violets*, *Heaths*, *Umbelworts* and *Gentians*. There are 640 pages and 1453 illustrations. The third and last volume will probably appear before the end of the year. We can supply either of the first two volumes bound in cloth for \$3.25, post-paid. A year's subscription to the *FERN BULLETIN* given with each volume ordered. Two volumes and a subscription this journal will be sent post-paid for \$6.25. Address all orders to the editor.

*The Fern Collectors' Hand-book and Herbarium, by Sadie F. Price, Henry Holt & Co., New York. Price \$2.25.

—Part X of Bulletin 9 of "Minnesota Botanical Studies" contains a paper by A. A. Heller entitled, "Observations on the Ferns and Flowering Plants of the Hawaiian Islands." Ninety-six ferns and nine fern allies are mentioned, seven of which are described as new. The author notes that outside of the lower cryptogams one-sixth of the native vegetation consists of ferns. *Gymnogramme Sadlerioides* and *Acrostichium Helleri* are figured in the report.

—Among the ever increasing number of books concerning the out-door world, a prominent place must be given to a charming little volume by Thomas Wentworth Higginson, entitled *The Procession of the Flowers and Kindred Papers*.^{*} In this book of 170 pages, the author has brought together six very felicitous sketches of nature in New England, entitled "The Procession of the Flowers," "April Days," "Water Lilies," "My Out-Door Study," "The Life of Birds," and "A Moonglade." Those who see the book will wish to read it, and those who read it will want to own it. It is worthy a place in the library of every one who loves nature.

—Students of lichens in America have always been greatly handicapped in their work for want of a proper treatise on the subject. With the exception of Tuckerman's publication, now considerably out of date, almost nothing has been written upon this class of plants. Lichenologists will be inclined to give a cordial reception to the recently issued *Text-book of Lichenology*† by Dr. Schneider, in which the subject has been very thoroughly treated. The work is divided into two parts, the first dealing with the history, general morphology and physiology of Lichens, and the second with the classification and special morphology of the plants. In the first part, symbiosis, reproduction growth, mechanics, chemistry, etc., of lichens is fully discussed, while the second contains excellent keys to the families and genera. Those who are studying the lichens will find this book invaluable. In addition to 230 royal octavo pages of text, there are 76 full-page plates illustrating all the genera.

^{*}The *Procession of the Flowers and Kindred Papers*, by Thomas Wentworth Higginson. Longmans, Green & Co., New York, price \$1.25.

†A *Text Book of General Lichenology* with descriptions and figures of the Genera occurring in the Northeastern United States, by Albert Schneider. Willard N. Clute & Co., Binghamton, N. Y., price (cloth) \$4.25; paper, \$3.80.

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	PAGE.
The Dicranums— <i>A. J. Grout</i>	86
The Genus Equisetum with Reference to the North Amer- ican Species— <i>A. A. Eaton</i> ,.....	45, 69
The First Meeting of the Chapter— <i>Willard N. Clute</i>	79
The Hair-cap Mosses— <i>A. J. Grout</i>	18
The Pogonatum or Bearded Mosses— <i>A. J. Grout</i>	38
The New Moss Chapter.....	85
The Santa Marta Expedition.	59
<i>Woodsia ilvensis</i> — <i>C. F. Saunders</i> ,.....	3
World Distribution of Some Eastern American Ferns— <i>C.</i> <i>F. Saunders</i> ,.....	49

INDEX TO CONTRIBUTORS.

Barclay, F. W.....	25
Bastedo, W. A.....	54
Bates, Miss Edith.....	12
Bates, James A.....	31
Beattie, R. Kent.....	72
Britton, Mrs. E. G.....	I, 42, 90
Burnett, D. A.....	43, 66
Classon, E.....	43
Clute, Willard N.....	10, 28, 52, 75, 76, 79
Collins, J. Franklin.....	90
Dodge, Raynal.....	31
Druery, Chas. T.....	26
Eaton, Alvah A.....	5, 30, 45, 69
Gilbert, B. D.....	4
Green, H. A.....	27
Grout, A. J.....	17, 18, 24, 38, 40, 62, 63, 66, 86, 90
Holzinger, J. M.....	67
Kennedy, Geo. G.....	43
Parsons, Frances Theodora.....	74
Price, Miss Sadie F.....	30, 31
Saunders, C. F.....	3, 21, 49
Schneck, J.....	84
Slosson, Miss Margaret.....	36, 51
Terry, Mrs. Emily Hitchcock.....	7
Vail, Miss Anna Murray.....	42
Waters, C. E.....	24, 55
Zirngiebel, Miss Frances.....	9

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WINTER NUMBER.

The
Fern
Bulletin.

A Quarterly Devoted to Ferns.

EDITED BY WILLARD N. CLUTE.

JANUARY.

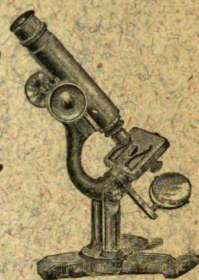
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THE FERN BULLETIN

VOL. VI.

JANUARY, 1898.

No. 1.

FOUR NEW SPECIES OF OPHIOGLOSSUM.

By E. G. BRITTON.

ON the Fourth of July excursion of the Torrey Botanical Club in company with the Philadelphia and Washington botanists, a patch of *Ophioglossum* was found by Mr. Joseph Crawford and Mr. Charles Louis Pollard near Wildwood, New Jersey, which was so different from the common forms of *O. vulgatum*, that we at once concluded it was a new species. It grew in open wood, under oaks, cedars and holly trees, not far from the beach, in soil so sandy that grass grew but sparingly, and bayberry bushes were common. The stalks were only slightly above the ground, but those of the fertile spikes were longer, and the spikes mostly twisted. None of the plants were more than 6-7 inches in height, and mostly two grew from the same rootstock. They had an erect, rigid habit, and at maturity were yellow in color, making the patch quite conspicuous, not only for the number of the plants, several hundreds grew together, but for their crowded position. A tuft five inches across would contain 20-30 plants. The leaf blades were thick, and rather fleshy, lanceolate or ovate-lanceolate in the larger ones, (1-2 inches) narrower and longer in the basal, sterile leaves. The venation was rather hard to see, even after they were pressed, and there were fewer basal veins, and less reticulate areolation than in *O. vulgatum*. After considerable correspondence and comparison of specimens, it has been discovered that *O. vulgatum* does vary greatly in the size and shape of its fronds, but none have been seen which agreed exactly in habit and constancy with the specimens from Wildwood, which have been described as *Ophioglossum arenarium*, n. sp.

Prof. Underwood called my attention to Prantl's revision of the genus ["Jahrb. d. K. Bot. Gart." Berlin, 3: 297-350, 1884], where are described two new North American species, thus far not included in any of our text-books, and seemingly unrecognized by

all our students of ferns. *Ophioglossum Engelmanni*, Prantl, was described from Texas and Arizona, and it has been found by various collectors in Missouri, Louisiana, Arkansas, Kentucky and Tennessee, Indiana and Virginia, as well as lower California. *Ophioglossum Californicum*, Prantl, has thus far been collected from only two localities in Mexico and Lower California besides the type locality at San Diego, California, where it was originally discovered by Dr. C. C. Parry.

Some specimens collected by L. M. Turner on Unalaska Id. Alaska, have also proved to be different from *O. vulgatum*, by which name they were distributed, and have been called *O. Alaskanum*, n. sp.

There has been much confusion as to the name which should be used for the smallest species of the genus which we have been calling *O. nudicaule*, L. This name belongs to an African species and Prantl enumerates five authors who have applied the name to seven different species, ours being *O. nudicaule* of Sturm in part. Prantl concluded to call it by a manuscript name of Mettenius, *O. tenerum*, but from notes by J. H. Redfield in the Eaton Herbarium, and the text as given in Nuttall's genera, it seems plain enough that *O. pusillum*, Nutt. 1818, is the name which belongs to the species of our Southern States.

A revision of the genus with descriptions, plates and full citations of localities appears in the December number of the *Bulletin of the Torrey Botanical Club*. I wish here to thank Mr. Alvah A. Eaton, Mr. Stewart H. Burnham and Miss Sadie F. Price, whose interesting notes in the FERN BULLETIN for October, 1896, led me to write to them for further information, and who have generously contributed specimens and notes which have been very useful. It is most important to note the habit and peculiarity of place of growth in collecting specimens, as they exert a great influence on the character of the variations. Mr. Burnham, particularly, has sent me a most interesting chronological series, beginning in May and extending through August, all from the same locality at different stations. His specimens show a great variation, and it would be very interesting to know if other collectors and readers of the BULLETIN have found similar varieties. The specimens which Miss Price described from dry, open woods and cedar groves at Bowling Green, Kentucky, have proved to be *O. Engelmanni*, though she has also found *O. vulgatum* at the same locality. We shall await with interest further notes and observations from the readers of this journal.

WOODSIA ILVENSIS.

By C. F. SAUNDERS.

WOODSIA ILVENSIS, that is, the *Elba Woodsia*, is a native of Arctic regions and mountainous parts of the temperate zone in Asia, Europe and America. In the United States its most southern recorded limit is North Carolina. The present writer's acquaintance with it is confined to the mountains of eastern Pennsylvania, where, without being rare, it is nevertheless among the less common plants. It is one of the few ferns that lend the grace of their presence to exposed rocks, and so do what they can to make pleasant the waste places of the earth. At Lehigh Gap, Penna, where the Lehigh river cuts its way through the wall of the Blue Mountains, this *Woodsia* grows in the open sunlight on rocks high up on the side of an almost perpendicular ascent facing the river. Twenty miles away it may again be found, in the rocky clefts of a shaded hillside along McMichael's Creek. In the latter locality, perhaps because protected from the direct rays of the sun, it grows more luxuriantly, and in point of graceful beauty challenges comparison with any member of its lovely order.

In Pennsylvania our fern is usually from four to six inches in height, and grows in tufts either on the face or top or in the crevices of the rocks. The dead fronds break off at a joint in the stipe a half an inch or so above the ground, leaving the lower portion of the stalks stiffly standing, and the living fronds are very frequently found surrounded by small plantations of such stubble. This joint (which is plainly discernible under a pocket lens) is a characteristic of several species of this genus and serves as a ready and sure means of distinguishing our plant from *Cheilanthes lanosa*, which bears a considerable resemblance to it and grows in similar situations.

The fronds of *W. Ilvensis* are thickly clothed on the back with hairs and bristly chaff. These in the young plants are whitish, and give to the whole back of the frond a silvery or frosted appearance, which, however, changes upon maturity to a brownish-red—a color possessed also by the chaffy stipe and rachis. Although it may seem on first acquaintance somewhat stiff and even coarse of habit, *W. Ilvensis* is one of the most interesting of our native ferns, and the unpretentious but sturdy, unwavering fight of the furry little plant with sun and frost will speedily win for it, I think, a place in the heart of any who will give it due attention.

ASPLENIUM FONTANUM IN THE WEST.

By B. D. GILBERT.

HOW would you like a bit of gossip to supplement your delightfully interesting article on *Asplenium fontanum* in the July number of the FERN BULLETIN? You imply in that article that this species has not been found "in this country," except in the two localities mentioned, although you say "it is not preposterous to suppose that the fern may occur in other parts of America." Now, in my herbarium there is a beautiful little plant, underneath which is the following original label:

U. S. PACIFIC COAST FLORA.
Asplenium fontanum, Var.
(New to U. S.) "Conservatory" (Canon).
Huachuca Mts., Ariz. Aug. 8, '82.
Lemmon Herbarium, Oakland, Cal.

Now if this label were correct, you see there would be another and probably a better vouched-for station, because no doubt more specimens were collected. The date is August 8, 1882. I have a letter from Prof. Lemmon, written at Fort Huachuca, Oct. 5, 1882, during the same expedition in which our fern was gathered. In it he describes how he broke one of the metacarpal bones of his hand in sliding down the steep walls of a cañon; "but," he says, with a fine disregard of the accident, "I found three more interesting ferns for my reward. Sent specimens of all to Prof. Eaton, but get no returns as yet. I think one or two of the ferns are new, at least they are not described in Eaton's great work.

So they were discovered too late to get into Eaton's "Ferns of North America," and, of course, too late to be in the first edition of Prof. Underwood's "Our Native Ferns," which was published in 1881. Now comes the question: Was Prof. Lemmon's label correct? The fern was sent to me with others in the following November, when, I take it for granted, Prof. Eaton had sent to Prof. Lemmon a provisional list of what thought the species might prove to be, after more careful examination and study. Prof. Lemmon had made up his sets and was anxious to distribute them, as his patrons were waiting to receive them; so he sent them out with the names originally furnished by Prof. Eaton. I

imagine, however, that there were very few specimens of this fern, as it was priced very high, and Eaton says it was "scantly collected." The final result of Eaton's examination will be found in his series of "New and Little-Known Ferns of the United States. No 13," published in *The Bulletin of the Torrey Botanical Club* of March, 1883. It appears under the head of *Asplenium Glenniei* Baker. Prof. Eaton says: "It is a small fern growing in little tufts like *A. montanum*, but the fronds are lanceolate, etc., etc. The fern *comes near* the Old World *A. fontanum*, but is not closely allied to any of our common species. I am obliged to Mr. Baker for the identification."

So near and yet so far! On the whole, it was better to have *Asplenium Glenniei* added to the United States flora than *A. fontanum*, as the former is, so far as known, a much rarer species in the world at large. Besides, as you have shown, *A. fontanum* does occur in the eastern states, while Arizona is the only region "in this country" where *A. Glenniei* has been found.

A NEW ISOETES.

By A. A. EATON.

DURING the spring of 1896, while examining specimens of the plant subsequently published as *Isoetes Eatoni*, I came across one of very peculiar aspect. The leaves were tortuous and interlaced or "snarled," the macro-spores large and crested, the microspores present in about equal quantity, the sporangia spotted. A minute search among hundreds of specimens failed to discover another, and the only specimens in my herbarium of similar aspect were some collected by Macoun on Vancouver Island in '90 and sent under name of *Nuttalli* (the real *Nuttalli* was, however, sent from the same section). Wishing to determine whether this was a freak or a new species, I made extended search in 1896 at the type locality of *Eatonii*. The pond is formed by damming Powow River in East Kingston, N. H., so it floods a space $\frac{1}{4}$ - $\frac{1}{2}$ mile wide and $1\frac{1}{2}$ miles long, extending back well into Kingston.

In the lower part of this pond—the type locality for *Eatonii*—the search was futile; but in the upper part, in Kingston, I found it in the greatest abundance, in places lining the banks in a strip a rod wide and 4 or 5 rods long, to the utter exclusion of everything else, the leaves, about 18 inches long, being so close set that they

might have passed as a grass patch. When growing so thickly the trunks were small, but when more scattered they sometimes attain a size of $1\frac{1}{4}$ inches, with 75 leaves, 18 inches long. These leaves under water ascend spirally, fall flat and decay on subsidence of water, and a new growth appears, shorter, tortuous and often intricately interlaced in a manner not heretofore noticed in any Isoetes.

I made several trips to the locality in '96 and observed it in all its phases. In '97 the water was not drawn off till the middle of September, so the immersed form was rarely observed, but it was characteristic so far as noticed. Inasmuch as the terms vernal and æstival as applied to the leaves imply a dependence on the season, while the forms depend entirely on the water, long when submersed, short when growing on the bank after the water has been drawn off, I abandon them and use the terms "submersed" and "emersed" leaves respectively, which terms are sufficiently self-explanatory.

ISOETES DODGEI, n. sp. *Trunk*, bilobed, .4-3^{cm} ($\frac{1}{4}$ -1 $\frac{1}{4}$ in.) in diameter; *leaves*, 10-75, submersed 20-45^{cm}. (8-18 in.) long, erect when plants are close set, spirally ascending when scattered, mostly female; emersed, stouter, 2-3^{mm}. (1-1 $\frac{1}{2}$ in.) in diameter, 10-15^{cm}. (4-6 in.) long, tortuous and intricately interlaced, mostly male, both with many stomata and usually 4 bast-bundles. *Ligula* 2^{mm}. (1" in.) long, sharply lance-triangular; *velum*, $\frac{1}{4}$ - $\frac{1}{2}$ indusiate; *sporangia*, thickly sprinkled with light-brown cells. *Macrospores*, globular, 500-675 μ , averaging 560 μ in diameter, sparsely covered with irregular crests, set on a reticulate pattern, especially on young spores. As the spores develop, the crests separate into irregular or isolated groups, with large bare spaces between, or rarely they extend across one face of the spore. They are always serrate or spinulose-rosulate at the top. *Microspores*, ashly, 22-40 μ , average 32 μ , papillose.

This belongs next *I. riparia*, from which it differs in its larger size, longer leaves, narrower vellum, more isolated and jagged sculpture of the macrospores, larger microspores, narrower dissepiments to the leaves, as, indeed, the whole interior structure is different; and especially in the bast bundles, which are nearly always present. At one time I thought it might be *I. riparia* var. *Canadensis* Eng., and had it compared with specimens at the Missouri Botanical Gardens, through the courtesy of Dr. Trelease. As they differ in so many points no doubt of their being distinct can be entertained.

It is very desirable to get specimens of the plants referred to *riparia* by Dr Engelmann, from Uxbridge, Mass., and Brattleboro, Vt., for comparison. The locality of Mt. Desert for *I. riparia*, given by Redfield & Rand is invalid, the plant being a large form of *Tuckermani*, which I call var. *boreale*. It seems strange this plant is so abundant at one end of the pond and not found at the other; also that it should be found at two localities so far apart as New Hampshire and Vancouver Island and not in the intervening space. As soon as competent collectors begin to hunt for *Isoetes*, however, it will doubtless be found common.

I take pleasure in dedicating this species to Mr. Raynal Dodge.

DORSET FERNS.

I WAS greatly interested in Dr. Underwood's article in the October BULLETIN, in regard to the Ferns of Scolopendrium Lake. It has stimulated me to write an account of a place in Vermont, which I believe to be equally remarkable. I believe this state is generally conceded to be one of the most profitable for students of Ferns. Certainly Dorset is both profitable and interesting. To be brief, let me say that at my boarding place I was known as the woman who found ferns, and requests were made to me to bring them in for general inspection. In response, one day, I said I would go for a walk, and in two hours I would bring home more than thirty varieties. Accordingly I started out to fulfill my promise, and at the time specified, I was on hand with thirty-seven varieties. I will name them in the order in which they occur in *Gray's Manual*, using also his nomenclature, as I am most familiar with that.

Polypodium vulgare, *Adiantum pedatum*, *Pteris aquilina*, *Asplenium Trichomanes*, *A. ebeneum*, *A. angustifolium*, *A. thelypteroides*, *A. filix foemina*, *Camptosorus rhizophyllus*, *Phegopteris polypodioides*, *P. Dryopteris*, *Aspidium Thelypteris*, *A. Noveboracense*, *A. spinulosum intermedium*, *A. s.*, var. *dilatatum*, *A. cristatum*, *A. c.*, var. *Clintonianum*, *A. Goldianum*, *A. marginale*, *A. acrostichoides*, *A. aculeatum*, var. *Braunii*, *Cystopteris bulbifera*, *C. fragilis*, *Onoclea sensibilis*, *O. Struthiopteris*, *Woodsia Ilvensis*, *Dicksonia pilosiuscula*, *Osmunda regalis*, *O. Claytoniana*, *O. cinnamomea*, *Botrychium lanceolatum*, *B. matricariaefolium*, *B. ternatum*, var. *obliquum*, *B. t.*, var. *dissectum*, *B. Virginianum*, *B. V.*, var. *gracile*, *Ophioglossum vulgatum*.

Most of these were in great abundance—the rarest one being *Asplenium angustifolium*. As the woods are being cut down where it grew, it will doubtless soon disappear, if it has not done so already. But in another part of the town it grows in great profusion, in company with *Aspidium Goldianum*. Indeed, the luxuriance of these two ferns in this second locality, exceeds anything I have ever seen elsewhere.

A walk in another direction was made memorable by finding *Asplenium Ruta-muraria* and *Pellaea gracilis*, each of them in great abundance.

Now in view of this long list of ferns, may not Dorset claim the first rank in point of variety?—*Emily Hitchcock Terry, Smith College, Northampton, Mass.*

DEVELOPMENT OF FERNS FROM SPORES.

A field in which very little has been done, but one which has much of interest in it for the student, is found in watching a young fern as it develops from the spore.

Miss H. D. Hutchinson who has been experimenting in this way with *Pteris serrulata*, sends a drawing showing the development of the first five fronds which is herewith reproduced. She writes that observation of numerous plants has shown

that the first three or four fronds are always produced after the same pattern. The seventh frond often fruits. We are also indebted to Miss Hutchinson for a series of plants showing these various stages of development.



BOTRYCHIUMS IN AN ODD PLACE.

BEFORE making a systematic study of ferns the Botrychiums were entirely unknown to me, I never having gathered them with other strange plants or even noticed their peculiar growth. Since making their acquaintance, however, they have always shown themselves whenever present and I have been able to distinguish them at a distance even when among other thickly growing plants. About Boston the typical *Botrychium ternatum* is quite rare, only a few specimens having been found in rich woods. The variety *obliquum* is, however, very plentiful in moist sunny pastures where it is associated with *var. intermedium* and *var. dissectum*. In each of two such places I have, in early September, collected over fifty specimens, their golden fruit being conspicuous among the grass and the purple gerardia, polygala, and running blackberry vines which frequented the same spots. *Botrychium ternatum*, varieties *obliquum* and *dissectum*, we often find near the paths under bushes in dark woods. In such places only a few specimens are found and these are seldom fruited.

During the first week of last August while in the Yellowstone National Park, I was astonished at finding two plants of *Botrychium* in a suprising location. At an altitude of about 7,500 feet is the mud geyser region. Here the mud-volcano belches forth, with disagreeable sounds, hot mud and steam, which having reached the plants in the vicinity has deposited upon their foliage a thin coating of the ejected matter. Within thirty feet of this crater are several boiling springs and it was on the edge of one of these, on a soil consisting in a great part of geyser formation and almost devoid of vegetation that I found in company with some little sedges, and, if I remember rightly, pipewort, that I found these *Botrychiums*. A few feet away a few large plants of a rugged species of the orchid *spiranthes* lent their erect white forms to the weird scene. There was considerable heat in this place as it was exposed to the sun and the ground was hot, too, from the internal heat which here and there manifests itself by cracking the surface and sending out steam and bubbles of hot water. Although growing in a situation unlike that in which we find this genus, these two plants flourished and seemed to be "to the manor born." The specimen which I have preserved grew to the height of seven inches. The fertile segment

has a long, coarse, hairy, ridged stalk. It has six pairs of pinnæ, the lowest pair being twice and the others once pinnate. It forms a heavy panicle of good sized pods and clearly shows its foliate origin. The sterile segment has a short thick petiole the divisions of which are large, hairy and somewhat contorted. The divisions and sub-divisions of this sterile segment follow close upon one another. They are somewhat ovate in form and denticulate. It most nearly resembles variety *intermedium*. On the whole it was a luxuriant plant. In another geyser basin more removed from any active spring and in a spot where a few trees were growing I found another plant of this moonwort.—*Frances Zirngiebel, Roxbury, Mass.*

NATURALIZATION OF EXOTIC FERNS.

RECENTLY three cases of exotic ferns becoming naturalized about New York have been reported. At a meeting of the Torrey Botanical Club, Dr. N. L. Britton reported the naturalization on Staten Island of a fern whose native home appears to be Japan. The other cases were reported by Mr. F. S. Curtis, who brought us plants of *Pteris tremula*, and what is doubtless *Dryopteris patens*, which he had collected on a stone wall at the entrance to the tunnel under Park Avenue in New York City. This tunnel is used by the New York Central Railway, and trains are passing constantly, yet in all the smoke and dust, exposed to the sun and with scarcely any moisture, these denizens of a warmer climate have persisted for years. One plant of the *Pteris* had nearly twenty fronds, living and dead, the tallest being seventeen inches high and well fruited. It is supposed that these plants originated from spores blown from some nearby florists. Walls in the city, facing the north, frequently bear young ferns in spring, but these do not exist through the summer. The others, however, have not only lasted through the summer, but what is the greater wonder, endured the rigors of a northern winter.—*Willard N. Clute.*

Mr. W. H. McDonald inquires where he can find *Onoclea Struthiopteris* growing near New York City. It seems to be the general opinion that this fern is not common along the seaboard, and we believe it is not known within one hundred miles of New York.

THE LINNAEAN FERN CHAPTER OF THE AGASSIZ ASSOCIATION.

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Fern lovers are cordially invited to join the Chapter. Active membership costs \$1.00 annually; Associate, 50c. This journal is sent to both classes free. Application for membership should be made to either President or Secretary.

Items for this department should be sent to Mr. C. E. Waters, Johns Hopkins University, Baltimore, Md.

—The report of the officers for 1897 will be issued some time in January and will be mailed to all members of the Chapter. It will contain a revised list of the members, and all who wish to make any change in their address should notify the Secretary at once.—C.

—The following new members have been admitted to the Chapter since October 1st: Miss Elizabeth Billings, Woodstock, Vt., C. H. Holcomb, Brookline, N. H., active, and Miss Mina K. Goddard, Lexington, Mass., associate. Miss Lura L. Perrine, an associate member, has changed to the active list.—C.

—The October election has given us the following officers for 1898: President, C. E. Waters; Vice-President, Mrs. A. D. Dean; Secretary, Alvah A. Eaton; Treasurer, Jas. A. Graves. The vote for President resulted in a tie between Messrs. C. E. Waters and Will R. Maxon, which the Executive Council decided in favor of President Waters. The full report of votes cast will appear in the annual report.—C.

—The plan for giving a fern book to members of the Chapter worked so advantageously last year that preparations for repeating the experiment are already being made. It is the intention of the Executive Council to place as much fern literature in the hands of our members as possible. A new fern book is nearly ready and will shortly be mailed to all active members whose dues are paid for 1898. The Treasurer, whose address appears at the head of this department, will promptly acknowledge all dues sent him. Associate members who wish to change to the active list may do so by sending the proper amount for dues with notice that they desire to change.—C.

—Mr. C. F. Saunders, 305 Walnut st., Philadelphia, Pa., whose excellent article on *Woodsia ilvensis* appears in this issue, will send a specimen of this fern to any member of the Chapter who encloses five cents in stamps for postage and packing. Mr. Charles Louis Pollard, who with Dr. Joseph Crawford, has the honor of discovering *Ophioglossum arenarium*, described by Mrs. Britton in this number, generously offers single specimens of it for five cents in stamps. His address is U. S. National Museum, Washington, D. C.

OUR MISCELLANY.

Mr. W. H. McDonald an indefatigable fern collector, writes that in a single walk in the vicinity of Bronxville, Westchester county, N. Y., he found no less than twenty-two species of ferns. Taking into consideration the nearness of this locality to New York City, the record is surprising.

Miss Edith Bates writes that on October 9th she found a quantity of *Asplenium pinnatifidum* within the city limits of Philadelphia, growing on gneiss rock. She discovered the locality about eight years ago, but thought it had been since exterminated at this point. The fronds were large and thrifty, one measuring seven inches long, and three of them were forking.

Mr. Samuel Henshaw, of the New York Botanical Garden, tells us of a new and unique way of procuring ferns from spores. It is merely to take a common flower-pot, stop up the hole in the bottom, fill it with water and set it in the greenhouse or conservatory near the ferns, of which young plants are desired. The water percolates through the pot just fast enough to keep the outer surface properly moist and the spores floating about in the air come in contact with this surface and at once germinate. Until they get their third frond they seem not to require more sustenance than they are able to procure in this situation.

The first number of the *Plant World* (Oct. 1897) contains a very interesting article on the Sword Moss (*Bryoziphium Norvegicum* (Brid.) Mitt.) by Mrs. E. G. Britton. Mrs. Britton tells in a delightful narrative way of her experience in collecting the fruit of this moss, which was before unknown. There is also a good plate and a complete description of the moss with the following list of N. American localities: Columbus and Lancaster, Ohio; lower Ohio and southern Kentucky; Dells of Wisconsin River; Ferns, Indiana; Lamoille Cave, Minnesota. Mrs. Britton offers to send a specimen (sterile) of the moss to all BULLETIN subscribers who send her a self-addressed stamped envelope.

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WILLARD N. CLUTE, Editor.

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IN a recent issue we mentioned some of the good things in store for readers of this magazine during 1898. In order to present these in acceptable form, we have now improved the mechanical side of the journal by new type and a better grade of paper. We hope this will have due weight with those who are trying to decide whether or not a journal which gives all the news regarding ferns is worth fifty cents a year. Many have expressed a wish that the FERN BULLETIN be issued oftener. This can be done either by increasing the subscription price or the subscription list; in other words, we must have larger revenues to do it. We do not intend to again raise the price of this journal, but if we can add five hundred more subscribers to our list, we will issue it bi-monthly. If each of our present subscribers will get us the subscription of a friend, we shall be ready for a more frequent issue at once.

* *

WITH this number we begin the publication of four pages extra, devoted to the mosses. So many of our fern students are students of the mosses also, that this department will properly fall in with their line of work. To those who are not acquainted with this fascinating group of plants, it may be said that here is a chance to know them. The clear and concise accounts of our common species which Dr. Grout and others are preparing for our columns, will enable all who wish for a better knowledge of them to obtain it, while the shorter notes will give the learner helps and "short-cuts" that are not found in the books. There is one thing

yet lacking among students of the mosses and that is an organization for mutual help, similar in scope to the Fern Chapter. Here is a chance for some energetic Bryologist to bring all these interests together into one strong society that will help the individual more than he can help himself. This journal will gladly do all it can to assist such a movement.

* *

ALTHOUGH the Fern Chapter has a page of its own, some mention of this active society, just finishing its fifth year of work, may be made here. In 1893 there were four persons who suggested a society for giving particular attention to the study of ferns. Before this had been organized the number of persons interested had increased to a dozen, and from that time to the present the Chapter has steadily increased in strength and influence. It has nearly reached, if not passed, the hundred mark in membership and the increase continues. The society has been of immense benefit to beginners in giving helps over hard places, and to older students in placing them in communication with others, leading to an exchange of specimens, the interchange of thought and the formation of lasting friendships. What was begun tentatively has proven by flourishing vigorously that there is a broad field for it in the realms of science.

* *

THE time at which the American Association for the Advancement of Science meets in Boston next summer, has been fixed upon as the date for a meeting of fern lovers. There are upwards of a hundred persons interested in ferns in that city and the knowledge that we are to have a meeting there, will, it is expected, bring as many more. Several instructive and valuable papers will be presented and other topics for discussion announced. Mr. George E. Davenport assures us that the Bostonians will take pleasure in welcoming students from other sections and an enjoyable time is anticipated. Committees and program will be published in our April issue.

* *

THE thanks of the Editor are due to some unknown friend in England for copies of the British Pteridological Society's reports for the years 1894-7. This society was founded in 1891 and has a membership of about fifty. One meeting is held each year for the discussion of matters pertaining to ferns and the reading of papers upon various subjects of interest to fern students. The titles of some of the papers that have thus far been presented are:

"Some Results of Fern-hunting in Ireland," "Fern Reproduction," "The Marvelous Side of Fern Life," "Ferns of the Diamond Jubilee," "Weissmann's Theory of Heredity and its Relation to Fern Life," "Selective Culture," etc. These titles will give some idea of the scope of the society, but one must read the papers themselves to understand how widely the aims of fern students in Europe differ from those in America. Here, the lovers of ferns, led by our own Fern Chapter, are giving attention to the life histories of the ferns, comparing forms as nature made them, discovering new stations in which they grow, and constantly increasing our knowledge by contributing the facts brought out by close and careful observation. In England, however, the interest in ferns has developed along very different lines. Starting with practically the same species that we have, their attention has been given almost wholly to the development of varieties, or monstrosities, as we would be inclined to call them. This is carried so far that an American student, although knowing the parent species well, might be much perplexed to name its wonderful offspring, so changed is it in appearance. In justice to our British cousins it must be said that the development of these varieties is not allowed to proceed hap-hazard, but all plants that do not come up to the proper standard of excellence are ruthlessly weeded out. Many of the forms are curious, some are beautiful and all are interesting, but we are inclined to think that in the study of our native ferns in their haunts the American student has the best of it.

NOTES.

—The latest aspirant for favor among lovers of botany, *The Plant World*, contains in its initial number an entertaining article on "Ferns of the Yosemite and Neighboring Sierras," by S. H. Burnham. The habitat and manner of growth of numerous western ferns are given.

—We have received from the author, Dr. A. J. Grout, a copy of his "Revision of the North American Isotheciaceæ and Brachythecia." In this revision Dr. Grout has correlated and brought up to date the recent work on the American species of this group of mosses which before was scattered in various publications. The habitat and distribution of each species receives considerable attention and a number of excellent keys reduces to a minimum the work of determining genera and species.

—*Popular Science News* for November contains an article on "Superstitions Concerning Ferns."

—The author of "How to Know the Wild-flowers" will soon issue another volume on the same lines for lovers of ferns. Those who have read her other volumes will await the new book with interest.

—The third number of the "Student's Handbook of the Mushrooms of America" has recently appeared from the press of A. R. Taylor, Washington, D. C., and is fully up to previous issues. It contains three colored and two uncolored plates, and the text includes an analytical table showing prominent characteristics of the genera of Agarics, with a list of the genera of Hymenomycetes.

—The following list of Monographs of North American mosses may be useful to those who wish more complete descriptions than those given in the Manual. The genera "Physcomitrium, Bruchia and Scouleria," Mrs. E. G. Britton; the genera "Thuidium and Claopodium", Dr. G. N. Best; "Brachythecia and Isotheciaceæ," A. J. Grout. These are all printed in the publications of the Torrey Club. The genus "Fissidens" has been revised by Prof. C. R. Barnes, and "Amblystegium," by Prof. L. S. Cheney. These last have been published in the *Botanical Gazette*. The following additional Monographs are being prepared: A completion of the "Leskeaceæ," Dr. G. N. Best; "Dicranum," Prof. R. H. True; "Eurhynchium," A. J. Grout.

—Mr. William Tricker has performed an acceptable service to flower lovers in the publication of his book, "The Water Garden,"* recently issued. The increasing interest in the cultivation of aquatics makes the present volume both timely and valuable. Apparently every point upon which the amateur may desire information is treated. The making of ponds, planting, hybridizing, propagating, seed saving, etc., all have their place in the volume. Not only does the author write of how and where to grow aquatics, but the margins of the aquatic garden receive attention as well. Several chapters are devoted to the hardy herbs, shrubs and trees that assist in making the shores attractive. The value of the book is further enhanced by nine plates, eighteen full page views and numerous illustrations in the text.

*"The Water Garden," by William Tricker. The A. T. De La Mare Printing and Publishing Co., New York. Small quarto. Price \$2.00.

MOSS DEPARTMENT.

EDITED BY DR. A. J. GROUT.

Items for this department should be addressed to Dr. A. J. Grout, Plymouth, N. H.

THIS department is opened with the purpose of enabling any one at all interested in mosses to get some knowledge of these plants without excessive labor or expense. The articles in this first number will be followed by articles on collecting, mounting, methods of study and other topics of general interest. In the following numbers, as in this, we propose to describe and illustrate one or more of our common mosses and to continue this so long as it seems helpful or advisable.

The editor will also try to identify for subscribers difficult specimens accompanied by notes and return postage, but will not agree to do so if either of the above conditions is not complied with. All letters requiring a reply must also contain return postage. The specimens will be kept unless something to the contrary is requested.

* *

It is also hoped that the BULLETIN may become a medium for the communication of bryological notes of interest in the same way that has been so admirably done in the case of ferns and fern-allies. Notes are earnestly solicited from all our moss students. The editor also plans to have ready for distribution specimens of as many of the species taken up as is possible. A nominal charge for each specimen will be made to pay for postage, labels, assistance in making up packets, etc. The same arrangements for distribution to subscribers will be made in this department that is made in the case of ferns, i e., members having mosses to distribute will announce the fact in the BULLETIN and send out their material at their own terms.

OUTFIT FOR THE STUDY OF MOSSES.

FOR the study of mosses we should have a good hand-lens, a compound microscope with a magnifying power of 100 to 200 diameters (a two inch eye-piece and a one-half and one-fifth lens make a good combination), a pair of dissecting needles, a pair of small sharp scissors, a pair of fine pointed forceps and a

pair of sharp eyes; also the following books: Lesquereux and James' "Manual of the Mosses of North America," price \$4.00; and "Analytic Keys to the Genera and Species of North American Mosses," by Prof. C. R. Barnes and Fred D. Heald, price \$1.00. Jameson and Dixon's "Handbook of British Mosses," costing about \$5.75. will be very useful.

Do not be appalled by the above list as it will be possible to learn many of the common mosses with the BULLETIN, hand-lens and the sharp eyes, and if driven to it one can do very well with the eyes and the BULLETIN alone. The editor knows twenty-five or more species of New England mosses that he can recognize without the aid of any lens, and nearly all of these possess characters sufficient to enable others to recognize them from a careful description accompanied by a simple illustration.

THE HAIR-CAP MOSSES.

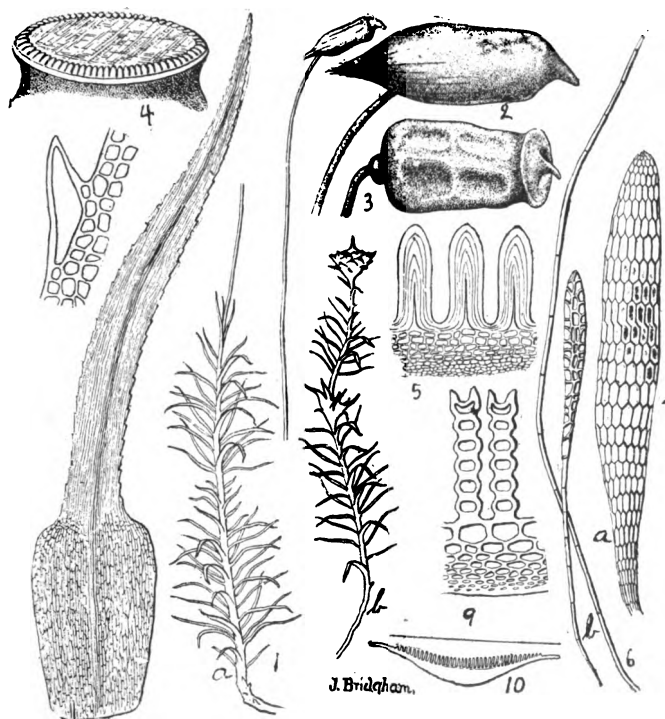
THE Common Hair-cap moss (*Polytrichum Commune* L), is the most common and easily recognized of the group. The

Latin and English names of this moss are both unusually appropriate. So common is it that scarcely any roadside or meadow is free from it. In many portions of New England it is a great nuisance in old meadows, entirely killing out the grass and covering the ground with a dark green mat of its closely growing upright stems.

From the figure of the fruiting plant it will be seen that it belongs to the acrocarpus division of the mosses, which have their fruit borne on the ends of the main stem. The plant with fruit grows from two to six inches in height. The base of the stem is fixed in the earth by a tangle of thread-like rhizoids which answer the purpose of roots and root hairs. Above are the leaves arranged in ranks, and from the top of the stem springs the long slender seta, bearing at the summit the square capsule or spore case. In the freshly matured plant the capsule is covered with a hairy cap (*calyptra*), whence the name Hair-cap Moss.

The seta and capsule of the moss correspond to what is commonly called a fern, while the rest of the plant corresponds to the prothallium, and if the base of the seta be carefully examined it will be found to be swollen and covered with little flask-shaped bodies, the archegonia.

The fruit of the moss has developed from just such a body which was fertilized by an antherozoid, produced in the anthe-



POLYTRICHUM COMMUNE L.

- 1.—Male and female plants, about one-half natural size. 2 and 3.—Capsules with and without calyptra. 4.—Mouth of capsule, enlarged. 5.—Teeth of peristome, greatly enlarged. 6.—Antheridium and paraphyses, greatly enlarged. 7.—Leaf, enlarged. 8.—Margin of leaf enlarged to show tooth and cells. 9.—Lamellæ, greatly enlarged. 10.—Cross-section of leaf to show lamellæ on upper surface.

Taken by permission from Mrs E. G Britton's "Mosses of the Eastern United States." (in preparation).

ridium (fig 6). The antheridia are borne on separate plants in terminal rosettes (fig 1). Both antheridia and archegonia grow intermingled with slender hairs called paraphyses (fig 6).

Returning to the capsule we shall find, if our plant is mature, that at the top of the capsule there is a lid or operculum (fig 3), which can be pulled off and which lets the spores escape. A strong dissecting microscope will be needed to see the antheridia and

archegonia and a compound microscope will be necessary to make out most of the following points:

If after removing the operculum we examine the mouth of the capsule under a low power we shall find it to be surrounded by a row of 64 teeth; this row of teeth is called the peristome. The points of the teeth are lightly attached to a membrane stretched across the mouth of the spore case. Under the compound microscope the leaves appear lanceolate and sharply serrate with a clasping base made up of large, nearly colorless cells, while the upper part of the leaf is much more dense, and is deep green. The midrib or costa is very broad and consists of several layers of cells while the margin consists of a single layer. In order to increase the light-receiving area this plant has adopted the curious contrivance of sending out from the upper surface of the costa radiating layers, lamellæ, a single cell thick. These are shown in a cross section of the leaf at fig. 10. The upper cell in this species is concave on its upper edge, as is shown in the greatly magnified lamellæ at fig. 9.

There are six species of *Polytrichum* which occur in New England. The most common species next to *P. commune* is *P. piliferum* Schreb., Awned Hair-cap Moss, which grows in dry situations around ledges and gravelly places. It is much smaller and is readily determined by the long slender awns at the apex of the leaves. I have collected this on the very brow of The Profile, Franconia Mountains. *P. juniperinum* Willd, Juniper-like Hair-cap Moss, is also common in woods or peat bogs and is easily distinguished by its lighter color and the incurved margins of the leaves. If you climb any of the higher mountains you are sure in moist places to find *P. strictum* Banks, the Erect Hair-cap Moss. This is distinguished from all our other species by the dense felt of radicles which sometimes covers nearly the entire plant, and from *P. juniperinum* of which it was formerly reckoned a variety, by the erect appressed leaves and cubical capsules. The three species last named have entire leaves. The only other species likely to be met with is *P. Ohienae*, Ren. and Card., Ohio Hair-cap Moss. This has serrate leaves and is not always readily distinguished from *P. commune* by an inexperienced observer. *P. commune* has the capsule cubical and entirely covered by the calyptra, while in *P. Ohienae* the capsule tapers into the seta and is not quite covered by the calyptra.

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
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THE FERN BULLETIN

VOL. VI.

OCTOBER, 1898.

No. 4.

THE GENUS *EQUISETUM*, WITH REFERENCE TO THE NORTH AMERICAN SPECIES.

BY ALVAH A. EATON.

SECOND PAPER.

USES.

THE ferns and allies of the past are of great economical importance, furnishing practically the whole flora of the Carboniferous forests, whence come our most extensive coal deposits. It is a strange fact that orders of plants and animals have always made their appearance in a burst of splendor, because the climatic conditions at their inception were favorable for their best development; but as earth changed in successive eons, it became necessary for her denizens to change location or habits, or to die. The more staid did the latter, while the more adaptive suited themselves to circumstances and broke up into species.

Thus we find that the present population of the earth is supported on the skeletons of ancestors. This is notably so with the fernworts. *Sigillarias* and *Lepidodendrons*, rising to the rank of forest trees, were the progenitors of our lycopods and selaginellas—now among our most humble plants—and the swamps of giant *Calamites* of the past are at present represented by their puny offspring, the marestails—of little value, either for use or beauty.

The *hyemalia* are oddly interesting plants, and a clump with dark green stems encircled with ashy sheaths is not wanting in attractiveness, especially in winter. *Silvaticum* is very beautiful when grown in shade. Very few, however, use the *Equiseta* in their ferneries. *Hyemale* is used by cabinetmakers in Germany, even to-day, to polish wood and horn, while *arvense* is in constant use to polish wood and tin in the kitchen, as it formerly was in this country. The buds of *arvense* are eaten by swine, and have been used by the poor in various parts of Europe for food, from remote ages. This species is diuretic, and was formerly used in chest and dropsical complaints; while the Chinese use

debile as an astringent. Some species are used at times as fodder for stock, mostly from lack of better material. Cows do not reject *arvense*, but do not appear to relish it. *Silvaticum* is the principal fodder of horses in some parts of Sweden, but is not relished by cows. *Fluviatile* has been used as food for cows and is reputed to induce an abundant flow of milk. *Lavigatum* is used as hay in parts of Nebraska, according to Rydberg, and *litorale* and *fluviatile* are cut along the borders of the Merrimac at Amesbury, Mass., but evidently are not valued highly.

Though of little use, the marestails of America are also free from the charge of being pernicious. *Fluviatile* and *litorale* border the shores of streams and slow brooks, the latter occasionally appearing in damp pastures; *pratense*, very pernicious in fields of central Europe, is rarely collected here, as is *palustre*. *Silvaticum* keeps to the shade of the woods or to field borders. Only twice have I seen *hyemale* growing in cultivated fields, and although it has grown among hoed crops in one locality for years, it never appears to do any harm. The only species having a tendency to become weeds are *arvense* and perhaps *telmateia*. The former grows extensively in the gravel of railroad grades and in damp fields among hoed crops, often covering the ground.

CLASSIFICATION.

There are two well-marked groups of *Equiseta* sufficiently well characterized to be classed as genera, though they have always been treated as sub-genera. The first, *Equisetum*, has fruit stems mostly different from the sterile, has stomata scattered in the grooves, and habitually regular verticils of branches. The stems are annual, usually perishing early in the season. The second, *Hippochate*, has the stems all alike, evergreen, persistent for three to four years, usually very rough with silex, branched (in ours) only in case of injury to the main stock, or where it has previously fruited. The branches are formed the second or third year. The stomata are in regular lines, usually one row on each side of a ridge. *Arvense* may be taken as a type of the first, and *hyemale* of the second.

The species of *Equisetum* are well characterized, while those of *Hippochate* appear in a measure to be geographical forms, the little *scirpoides* of the north being connected with the great *giganteum* of Mexico by a more or less continuous chain of intermediate species. It is often extremely difficult to determine

a species of this sub-genus, and it can only be done by a microscopical examination of the epidermis and interior. The following characterization has been adapted from Milde's "Monographia Equisetorum:"

EQUISETUM L.

Stomata forming a single broad line, composed of several rows, or with two irregular lines, often scattered, set obliquely, without regularly formed cells between them; the surface of the stomata overlaid with a plate of silex, which is free at the edges, and which shows a small vertical slit in the middle—corresponding to the opening of the stomata. Plants with usually two kinds of stems, spike blunt, rhizome without silicious dots, species easily separated by prominent characteristics.

A. EQUISETA HETEROPHYADICA A. Br.

Stomata always forming two separate rows; stems dimorphous; fertile at first branchless, pale, smooth, without stomata or bast, evanescent, or developing branches, chlorophyl, stomata and bast; sterile with dense verticils of branches, which are without central cavity; inner cylinder (*i. e.*, the parenchyma cells surrounding the central cavity) composed of thickened cells.

a. *Equiseta anomopora* Milde.

Stomata wanting or forming two contiguous rows, made up of 2-6 lines each, in the middle of the grooves.

- (1.) *E. arvense* L. (2.) *E. telmateia* Ehrh.

b. *Equiseta stichopora* Milde.

Stomata widely separated, forming 1-2 lines, high up on the ridges; fertile stems at first pale, branchless, smooth, without stomata or bast, very soon developing branches, chlorophyl, stomata and bast, and becoming rough.

- (3.) *E. pratense* Ehrh. (4.) *E. silvaticum* L.

B. EQUISETA HOMOPHYADICA A. Br.

Stomata forming a single, very wide row in the grooves, consisting of many lines; branches wanting, scattered or in verticils, with central cavity.

a. Inner cylinder composed of thickened cells. (5.) *E. palustre* L.

b. Cells of inner cylinder not thickened. (6.) *E. fluviatile* L. (7.) *E. litorale* Kuhlw.

NEBRASKA FERNS AND FERN ALLIES.

THE student of ferns finds that Nebraska does not offer a very wide or a very fertile field for his researches. Although our flora as a whole is rich and varied, it is greatly lacking in these interesting and beautiful plants. This fact is easily understood when we remember that ferns love the shady ravines of the wooded parts of the Eastern States or the dense thickets of the tropical jungles. Here on the great plains the sunlight is too powerful and the air is too dry to present favorable conditions for them.

There are, however, a few ferns which have thickened their epidermis, have accustomed themselves to life under difficulties, and are found in dry soil or on almost barren rocks in the bright sunlight. And it is true there are a few localities in the State where conditions favorable for fern growth are approached. In the bluffs along the Missouri river there is now and then a delightful ravine, shaded by overhanging trees, carpeted with mosses and liverworts, and kept always moist by a small stream flowing down its midst from the limestone springs above. In this soft, velvety moss-carpet, ferns are abundant in number of individuals, if not of species. In the hills in the northwestern part of the State moist cañons are numerous and in them ferns abound. Franklin and Kearney counties, in the southern part, also possess a number of localities favorable for fern growth. These facts have made it possible for a few ferns and fern allies to become a part of the flora of our State.

Out of the about 4,000 known ferns and fern allies, only twenty-six are reported for Nebraska. Five of these occur generally throughout the State. *Cystopteris fragilis*, the bladder fern, with its tufts of leaves, bearing on their backs roundish fruit dots, is probably the most abundant. *Botrychium Virginianum* is found near the heads of ravines among the fallen leaves. It is one of the more primitive ferns and bears its spores in a grape-like cluster of spore cases branching off from the vegetative part of the leaf near the base of the blade, which is broad, delicate and much divided. Three scouring rushes or horsetails are found generally over the State, *Equisetum arvense*, *E. robustum*, and *E. lævigatum*, the latter being more abundant in the eastern part.

The rest of our ferns are more local in their distribution. In the Missouri bluff region we find *Adiantum pedatum*, the maiden-hair, with its delicate, spreading leaves, bearing lunate fruit dots

just under their reflexed edges. *Pellaea atropurpurea* clings closely in the crevices in the sandstone cliffs along the Missouri river, and is only to be obtained after a careful search and a hard climb. This fern has fruit dots similar to those of *Adiantum*, but the lines of fruit are continuous and the leaves are much coarser in texture. On the top of the hills at Weeping Water grows a small fern, the back of whose leaves is covered with a starch-like powder. This is *Notholaena dealbata*.

Three more ferns and fern allies are reported from Franklin county. *Botrychium ternatum*, another moon-wort; *Equisetum variegatum*, a scouring rush, and *Osmunda regalis*, the so-called "flowering fern," are here found. Franklin, Nebraska, is the only locality west of the Mississippi river from which this fern has been reported.

Over half of our twenty-six ferns are found in the north-western part of the State, where some of the Rocky mountain conditions prevail. *Onoclea sensibilis*, the sensitive fern, and *O. Struthiopeteris*, the ostrich fern, creep across the Dakota line. *Aspidium spinulosum*, *A. thelypteris* and *A. cristatum*, three shield-ferns, are found here. *Cheilanthes lanuginosa* here, as elsewhere, protects its spores from the winds and weather by covering them with a layer of fine brown hairs. *Woodsia oregana* and *W. obtusa*, two delicate little ferns, are found in the cañons in the foothill region. *Asplenium Filix-foemina*, the so-called "female fern" of the ancients, shows its large and graceful leaves in the same localities. *Equisetum limosum* is found in the northern part of the State.

Marsilia vestita, a small aquatic fern, is also found in these parts. Each of its leaves is divided into four leaflets and presents almost the appearance of a "four-leaved clover." The spores are borne inside of pods formed by modified leaves.

Probably the most interesting of all the fern allies which we have in the State has been reported but once. *Isoetes melanopoda* has been collected near Exeter. As this genus, *Isoetes*, is probably that which, of all existing genera, comes nearest the flowering plants, a great deal of interest is attached to it. The plant grows in the edge of shallow water. It is very similar in appearance to grass and is therefore hard to find. It may be distinguished from a clump of grass by the swollen bases of its leaves, and in the leaf bases the spore cases filled with many small spores. To discover this form elsewhere should be the aim of every collector of ferns and their allies in the State.

There are probably a few other ferns than those mentioned here which grow as yet undiscovered within our borders. The above mentioned ones have been collected by the Botanical Survey of the state, conducted under the management of the Botanical Seminar of the University of Nebraska, and have been deposited in its herbarium at the University.—*R. Kent Beattie, A. M., The University of Nebraska, Lincoln, Nebraska.*

A NEW STATION FOR THE HART'S-TONGUE FERN.

LAST July on an expedition to Perryville Falls, Madison county, N. Y., planned for the purpose of finding the rue spleenwort and the purple cliff-brake, a new station was discovered for the hart's-tongue.

To Miss Murray Ledyard, of Cazenovia, belongs the honor of finding the first plants in this locality. We had been successful in the original object of our journey and had crossed to the west bank of the stream to examine the cliffs on that side. J. and I, curious to study the wet wall of rock close to the sheer white veil of water which fell more than 100 feet, finally secured an unsubstantial foothold among graceful tufts of the greenish, lily-like flowers which ought to receive a more appropriate title than *Lygadenus elegans*.

Having satisfied ourselves that the mossy crevices harbored no plants of the slender cliff-brake, now the immediate object of our search, we followed the natural path beneath the overhanging rock and above the sheer descent to the ravine, examining the cliffs as we cautiously picked our way. Miss Ledyard had remained below and suddenly we heard her give a triumphant shout, followed by the joyful announcement that she had found the hart's-tongue. On entering the ravine we had discussed the possibility of such a discovery, but I had fancied that any hope of it was unfounded, as I supposed the ground had been thoroughly canvassed by the many botanists who had visited the neighborhood.

The plants were still young, but large and vigorous, growing in a partial opening among the basswoods, maples and beeches on a steep slope covered with fragments of limestone, some thirty or forty feet from the base of the cliffs. We must have found anywhere from twenty to thirty plants within a radius of as many feet.—*Frances Theodora Parsons, Cazenovia, N. Y.*



CAMPTOSORUS SIBIRICUS.

WE present herewith an illustration of our walking fern's only near relative, *Camptosorus Sibiricus*. It is a native of the far east, and it is rare that a specimen finds its way into an American collection. The plant figured here came from Japan.

It will be seen that while there is a general resemblance between the two species, there are many points of difference. In *Sibiricus* the base of the frond is not heart-shaped, and the auricles, if any, are smaller. In the American species the frond is broadest at base; in *Sibiricus* it is narrow at base and usually much broader at about the middle. *Sibiricus* is also usually smaller and has thinner foliage than *rhizophyllus*. The species are alike in fruiting at the apex of the fronds, and in producing sterile fronds that differ somewhat from the fertile. In *Sibiricus* these are ovate or lanceolate, and in *rhizophyllus*, nearly triangular or with a rounded apex.—*W. N. C.*

NOTES FOR THE BEGINNER.

III.—COLLECTING AND PRESERVING.

THE object of an herbarium is to preserve our plants in proper shape for study until we may need them. It follows, then, that in collecting specimens we should get everything that will aid us in such study. Of primary value is the fruiting frond, but it is not well to content ourselves with this alone. When the plants are small the whole plant may be taken, especially if there is a difference between fertile and sterile fronds, but for large ferns, single fronds will do, and these may be bent or doubled to allow them to fit the dimensions of the herbarium sheet. Sections of rootstocks, young fronds and all variations from the normal should be collected, as they often throw much light on the species.

Get the plants from the field to your home as quickly as possible and by any method you prefer—between the leaves of a book, in a tin box of proper size, or even by carrying in the hand if it can be done before they wilt. At home, procure driers of blotting paper or other bibulous stuff—about 12 by 18 inches is a convenient size—and place the ferns between them with date and place of collection marked. Upon the top of this pile of ferns and driers, place a weight heavy enough to prevent the plants from shriveling while drying. To make the best specimens, fresh driers should be substituted for those in use at the end of the first twenty four hours, and the ones in use dried; but the writer has seen good specimens that were simply placed between newspapers without further attention until dry—say at the end of two weeks.

When dry the plants are mounted on heavy ledger paper or light cardboard, which *must* be of the standard size, 11½ by 16½ inches. This is the only *must* in herbarium-making, but it cannot be disregarded. Mounted on sheets of the standard size, plants will always be worth preserving; on other sizes and their value is lessened to all but the collector. One can always sell or exchange properly mounted specimens; it is often difficult to give the others away.

For fastening the plants to the sheets, liquid glue is recommended. It should be spread thinly on a smooth surface, the plants dipped into it and laid on the mounting sheet in the positions in which they are to remain. Place the mounted specimens between driers and under a weight until the glue has dried. The label should always be pasted on the lower right hand corner of

the mounted sheet. It should contain the name of the locality where the specimen was collected in any event. The name of the collector, name of plant and date of collection may also appear upon it, but locality is of first importance. "Where is it from?" is the first question asked by the botanist.

There are other ways of mounting plants—by sewing to the sheet, fastening with gummed paper or linen, etc., but these are not good for ordinary work. Heavy parts are sometimes sewed to the sheet, and it is customary to strengthen stems and other stiff parts by placing narrow strips of gummed linen across them, but plants keep best if they are glued to the sheet first. — *W. N. C.*

THE LINNAEAN FERN CHAPTER OF THE AGASSIZ ASSOCIATION.

President, C. E. WATERS, Baltimore, Md.

Vice-President, MRS. A. D. DEAN, Scranton, Pa.

Secretary, ALVAH A. EATON, Seabrook, N. H.

Treasurer, JAS. A. GRAVES, Susquehanna, Pa.

Fern lovers are cordially invited to join the Chapter. Active membership costs \$1.00 annually; Associate, 50c. This journal is sent to both classes free. Application for membership should be made to either President or Secretary.

Items for this department should be sent to Mr. C. E. Waters, Johns Hopkins University, Baltimore, Md.

—Miss E. Cannon, 431 Bartlett St., San Francisco, Calif., offers free to members of the Chapter, specimens of *Polypodium Scouleri* from the vicinity of San Francisco. Those desiring specimens should send Miss Cannon five cents in stamps for return postage. — *W.*

—The twenty members who were at the Boston meeting comprise nearly one-fifth of the entire Chapter. When it is remembered that a large number of our members are in the Central and Western States, or in other localities far from Boston, the number attending is worthy of note. Two members traveled more than four hundred miles each to attend this single meeting. — *C.*

—Those who were fortunate enough to attend the Boston meeting saw at once that the papers presented were of unusual interest, and in order that they might not be dispersed in various scientific journals it was decided to bring them together into one volume, to be published by a committee named at the meeting. The volume will be published by subscription, and only enough

copies will be issued to supply orders. The cost will be less than twenty-five cents a copy. One person may subscribe for several copies if he chooses. No cash is to be paid until the volume is ready, but all who wish a copy should notify the editor of the *FERN BULLETIN* at once, by postal, stating number of copies desired, as no extra copies will be issued. All members of the Chapter will want a copy of this report; no one who loves ferns can afford to be without it. The volume will appear as soon as it can be learned how many copies need be issued.—C.

—The dues of about a dozen members of the Fern Chapter remain unpaid for 1898. Our invariable rule is not to send copies of the *BULLETIN* to those in arrears for dues, but as soon as these are paid, the back numbers for the year will be sent. Members who pay up now, will not only receive the volume for 1898, but will be entitled to vote at this election, and be sent a copy of the pamphlet "Ferns of the Upper Susquehanna," which has recently been mailed to members.—C.

—It is certainly remarkable that during the six years that the Fern Chapter has been in existence, every quarter has been marked by an increase in membership. A roll of a hundred members was once considered to be unattainable; now, five hundred would not be thought too large. The following members have been admitted since July, bringing our list up to one hundred and nineteen: Active—Miss Mary Andrews, 283 Elizabeth St., New York City; Miss Agnes W. Lincoln, 10 Island Ave., Medford, Mass.; Mrs. Addie Howarth, Amesbury, Mass.; Mr. Walter R. Davis, 139 Park St., Newton, Mass.; Mrs. W. R. Davis, 139 Park St., Newton, Mass. Associate—Mrs. Willis Baldwin, Hunter, Greene Co., N. Y.; Miss Ella A. Noyes, 12 Essex St., Newburyport, Mass.; G. A. Woolson, Pittsford Mills, Vt.; Mr. Phillips Barry, 33 Ball St., Roxbury, Mass. The names of all members admitted during the year will be added to the list of members in the annual report issued in January.—C.

Election of Officers.

The sixth annual election of officers for the Chapter will be held in October. As required by the Constitution, the Executive Council have nominated two candidates for each office as follows:

For President—Alvah A. Eaton, Seabrook, N. H.; H. A. Green, Chester, S. C. *For Vice-President*—W. A. Murrill, Ithaca,

N. Y. ; C. K. Dodge, Port Huron, Mich. *For Secretary*—Will R. Maxon, New York City; George L. Parmele, Hartford, Conn. *For Treasurer*—James A. Graves, Susquehanna, Pa. ; Miss E. H. Thompson, Litchfield, Conn.

Balloting begins October 1st, and ends November 1st. Only active members may vote. President Waters has appointed Miss Margaret Slosson, Pittsford, Vt., as judge of elections, and to her all votes should be sent, preferably by postal card. The naming of the candidates above will not prevent members from voting for other active members if desired.

THE FIRST MEETING OF THE CHAPTER.

THAT a body of students interested in a single branch of science could continue to exist for six years without a meeting, speaks well for the enthusiasm of its members. This same enthusiasm took twenty members of the Linnæan Fern Chapter to Boston on Wednesday, August 24th, to the first meeting the Chapter has ever held. The meeting was successful beyond the most sanguine hopes of its promoters. The papers were listened to by an audience of nearly a hundred fern students, many of whom had come long distances especially for this meeting. So far as could be learned, the members of the Chapter attending were: Messrs. Bates, Davenport, Eaton, Gilbert, Davis, Grout, Fletcher, Kingman, Floyd, Barry and Clute, Mrs. Stevens, Mrs. Rich, Mrs. Davis, Mrs. Coffin, and Misses Hutchinson, Lincoln, Howarth, E. A. Noyes, and Zirngiebel.

The meeting was announced to be held in Horticultural Hall from 9:00 A. M. to 2:00 P. M., but some time before the hour set students began to arrive. People who had corresponded for years here met for the first time, and so busy were all in getting acquainted that it was with some difficulty that the program for the day was begun.

At about 10:30 A. M. Secretary Eaton called the meeting to order and in the absence of the president, Willard N. Clute was elected chairman. To the cordial address of welcome from Mr. Geo. E. Davenport, Rev. James A. Bates made a happy reply in behalf of the Chapter, and the papers for the day were then taken up. The first, on "Hybridity in Ferns," was presented by Mr. Geo. E. Davenport, who discussed the possibility of fern hybrids. His paper was prefaced by some remarks on the variation in the

fronds of dimorphic ferns and was discussed by Messrs. Grout, Eaton, Pollard, Gilbert, Clute, and Mrs. Britton.

Dr. Grout illustrated his paper on "An Interesting Variety of *Osmunda Claytoniana*" by herbarium specimens of the plant in question. The paper was commented upon by Messrs. Davenport, Grout and Clute. In the absence of Miss Mary A. Fleming, her paper on the "Ferns of the Urals and Caucasus," detailing a trip through those regions, was read by the secretary. The paper by Willard N. Clute, on "The Distribution of Some Eastern American Ferns," discussed the distribution of some eastern ferns with restricted ranges. The paper was commented upon by Messrs. Eaton and Gilbert.

Mr. B. D. Gilbert's paper, on "The Genera of Ferns; a Study in the Tribe *Aspidieæ*," in which he proposed several important changes in the disposition of the genus *Aspidium* and allied groups, was well received and discussed at some length by Mr. Davenport. Three hundred specimens were used by Mr. Alvah A. Eaton to illustrate his "Notes on a Peculiar *Botrychium*," which he held to be a new species or a remarkable variation of an old one. This was also discussed by Mr. Davenport.

Mrs. E. G. Britton ended the program with an interesting "Study of *Ophioglossum vulgatum*," in which she spoke of the recent changes in the way in which the so-called forms of this species have been regarded. Before adjournment a vote of thanks was given the Massachusetts Horticultural Society for the use of the hall, and to those who had been instrumental in making a Chapter meeting possible.

A field meeting had been planned for the afternoon, but those attending the morning session found so many things to discuss that it was decided to return to the hall after lunch and spend the rest of the day in conversation. This session proved fully as enjoyable as the other, many finding it difficult to decide whether hearing the papers read or meeting fellow members was the more pleasing. The hall was decorated with many varieties of our native ferns in vases and several members exhibited herbarium specimens, notably Mr. Davenport and Miss Zirngiebel. Upon invitation of Mr. W. R. Davis, a visit was made to the rooms of the Apalachin Club, where a collection of exotic ferns was seen. Gradually the party broke up as various members hurried away to catch their trains, and thus ended the first and long to be remembered meeting of the Fern Chapter.—*W. N. C.*

—THE—
FERN BULLETIN.

A QUARTERLY DEVOTED TO FERNS.

Official Organ of the Linnaean Fern Chapter.

WILLARD N. CLUTE, Editor.

THE FERN BULLETIN CO., PUBLISHERS, BINGHAMTON, N. Y.

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Communications intended for the editor should be addressed to Willard N. Clute, 63 E. 40th St., New York City.

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ANOTHER volume of the FERN BULLETIN is completed with this number. As it has progressed we have not failed to note several features which we believe can be improved upon in the new volume. In doing this we shall attempt to meet the expectations of those readers who take it for granted that every volume shall be an improvement upon the one that preceded it. It is almost needless to add that a prompt renewal of subscriptions will have an immediate effect upon these improvements. We would also urge that our readers speak of the journal to their friends. With a larger circle of readers, we shall be able to make a journal that approaches much nearer to our ideas of what such a publication should be.

* *

BEGINNING with the next number we shall publish an exchange column, in response to a considerable demand for one. Members of the Fern and Moss Chapters and subscribers to this journal will receive coupons entitling them to notices in this column at nominal rates; to others the price will be twenty-five cents for twenty-five words. Members' coupons will be sent by the treasurers of the Chapters upon payment of dues. Subscribers' coupons will be mailed from this office.

* *

THE success of the Boston meeting has emboldened us to try it again, and it is likely that an annual meeting will be a regular feature of the Chapter in future. Although this was the first

meeting of such scope as to include all students of ferns, the editor has pleasantly in mind two smaller meetings in which he was one of a party of Chapter members to meet for discussion of our favorite plants. The practice is to be commended to those who live in sections where there are several fern students, and we hope to have many reports of such meetings.

* *

IN this number we publish an account of a new locality for the hart's-tongue fern by the author of "How to Know the Wild-flowers." Although the station has been known for less than three months, the finders already have cause to regret that a knowledge of the location was made public. The vandal who delights to uproot and carry away specimens because they are rare has begun work in the new station, where, unfortunately, the ferns are not protected as they are at Chittenango Falls. Destructiveness seems to be one of the characteristics of uncivilized man that is most difficult to eradicate. Until the race reaches a point where it can enjoy and not destroy, plant lovers must use every precaution to prevent the extermination of our rarer species.

* *

ONE of our most pleasant experiences this season was the finding of *Schizaea pusilla* in its New Jersey haunts. After one has spent some time in the "pine barrens" in which it grows, he is likely to become impressed with the idea that the fern is commoner than the books would have it. Apparently it requires no unusual conditions for growth—we found it about the knolls in a half-dry swamp—but its size renders it very easy to overlook. When one knows just where to search and what to search for, the finding is much easier. It may take some time to find the first specimen, even in places where it is known to grow, but after that the eye becomes marvelously quickened, and the fruiting spikes like tiny fists appear in many places in the shade of other vegetation. We could have collected a hundred plants in half an hour, but forbore to contribute to its destruction.

* *

A NEW station for *Dryopteris simulata* was discovered by the editor at Babylon, N. Y., in September. This seems to be the first recorded station for the fern on Long Island. It grew in great quantities in a shaded, swampy piece of ground. Our quest was for fertile fronds of *Woodwardia areolata*, whose sterile fronds abound in the locality, but the new fern attracted attention at

once. It could be distinguished at a glance from *Dryopteris thelypteris*, which grew with it, by the habit its fertile fronds have of drooping somewhat, making a more graceful plant. Although the fern was fruiting abundantly, it was exceedingly difficult to find good specimens because of the ravages of a small worm that eats the spores and spins a web over the pinnæ as he goes.

NOTES.

—Under the title of "A Plea for Preservation," Miss Harriet Wheeler contributes to the July *Plant World* a timely article upon the carelessness of collectors in rooting out rare plants in order to make a show with their collections. Mention is made of a locality for the climbing fern, near Hunter, N. Y., which was entirely destroyed to gratify the desires of the "summer boarder."

—The formation of a Moss Chapter will add another to the list of Correspondence Chapters so popular in the Agassiz Association. There is scarcely a natural science that has not a Chapter of this kind for its study. Botany, Geology, Entomology, Ornithology and others are represented, and if the student finds none of these to his liking, he can still join the association as a corresponding member, where he will be put in communication with many students with similar tastes, or, better, he may form a local Chapter in his own town. The Corresponding Chapters have official organs of their own. The official organ for the Association at large is *Popular Science News*, and short articles for this are desired. All communications regarding the Association should be addressed to Mr. H. H. Ballard, President of the Agassiz Association, Pittsfield, Mass. Membership in any one of the Corresponding Chapters makes one a member of the main Association.

—In the *Journal of Botany* for August, 1898, figures of *Botrychium matricaræfolium* and *B. lanceolatum* are given, and the accompanying text claims for them a place in the British Flora. The chief claim for *matricaræfolium* rests on a somewhat doubtful species collected "on the sandy sea-shore of Stevenston, Ayrshire, in July, 1897." The plant was subsequently mislaid and afterwards brought to light from its resting place inside of an old catalogue. *B. matricaræfolium* has long had a half-recognized right to a place among British plants, having several times been figured or described as a variety of *B. lunaria*. It is also reported to have been frequently confused with the continental *B. rutaceum*.

While the author is satisfied that his plants are true *matricaræfolium*, it would seem to us from their habitat ("sands of Barry" and "sandy seashore"), that they might be referred with more propriety to some other species, since our plants do not affect such places.

—In the preface to "A Guide to the Study of Lichens,"* Dr. Schneider tells us that the volume is an attempt at popularizing our present knowledge of the lichens. After carefully examining the book, we are willing to agree that he has succeeded very well in the attempt. The majority of people are prone to consider lichenology as a very dry subject, but Dr. Schneider's presentation of it is anything but dry. Part 1 of the volume deals with the history of lichenology, the uses of lichens and a rather extended discussion of their structure and life histories. All of this is made very readable by numerous interesting facts about lichens which might not be necessary to a scientific presentation of the subject, but which the general reader will be very glad to have. The collection, study and preservation of lichens also receive considerable attention. In part 2 the systematic study of the plants is taken up. An artificial key to the genera occurring in the United States is given and also a key to the families. All the species which the average collector is likely to find in his rambles are described, and here again the author has added many entertaining notes. The work ends with a list of the lichens occurring in the United States. The author's ability to treat of the scientific side of the subject is vouched for by his recently issued "Text-Book of General Lichenology," and we doubt if any other writer could present the popular side more acceptably. Dr. Schneider may be open to criticism for the use of too many scientific terms in a work of this nature, or at least to their use without sufficient explanation, especially as no glossary is given, but this is not sufficient to detract from the merits of the work. The book contains 234 pages, with twelve full-page plates illustrating generic spore-types, drawn by the author.

*A Guide to the Study of Lichens, by Albert Schneider, M. D., Ph. D. Bradlee Whidden, publisher, Boston. 8 vo. Price \$2.50 net.

I see on page 26 of the April BULLETIN that the impression appears to prevail that *Pellaea atropurpurea* shows great preference for calcareous rock. It is frequently found here on perpendicular bluffs of sandstone, belonging to the Carboniferous and Quarternary periods.—*J. Schneck, Mt. Carmel, Ill.*

THE BRYOLOGIST,

A DEPARTMENT OF THE FERN BULLETIN,

DEVOTED TO THE STUDY OF NORTH AMERICAN MOSSES.

EDITED BY DR. A. J. GROUT, PLYMOUTH, N. H.,
To whom all correspondence regarding the mosses should be addressed.

This department is issued separately at twenty-five cents a year. Subscriptions should be addressed to the Fern Bulletin, Binghamton, N. Y.

THE NEW MOSS CHAPTER.

THE proposed Moss Chapter has received support beyond the expectations of the Editor and his friends. Not only beginners, but several of the more prominent moss students, have volunteered their support. It is therefore proposed to form a correspondence Chapter of the Agassiz Association for the study of mosses, with a constitution similar to that of the Linnæan Fern Chapter. It seems appropriate that this Chapter should be called The Sullivant Moss Chapter, after that "Prince of American bryologists," William Starling Sullivant.

Mrs. Britton, the Editor of the FERN BULLETIN, and the Editor of the BRYOLOGIST, will act as a committee to name officers for the first year, and their appointments will be published in the January BRYOLOGIST. After this officers will be elected according to the Constitution. The Editor will act as secretary and treasurer *pro tem.* until that time, and all dues and correspondence should be directed to him until the appointments of officers are announced.

The officers appointed will constitute a committee to draft a constitution to be acted upon by the Chapter as soon as convenient.

The Chapter will be entitled to a page in each issue of the BRYOLOGIST for Chapter notes and news. All who join as active members before January 1st, 1900, will be entitled to a free copy of the Editor's "List of Vermont Mosses, with Keys." They shall also be entitled to exchange notices at the same terms as members of the Fern Chapter. The annual dues will be 25 cents for associate members and 50 cents for active. Both classes will receive the BRYOLOGIST free, but only the active members shall vote or hold office. Members of the Fern Chapter can become active

members of the Moss Chapter by paying 25 cents annually, but such members shall not be entitled to a separate copy of the *BRYOLOGIST*. All revenue for dues, etc., will go directly into the treasury of the Chapter, to be expended for the Chapter by the officers elected for that purpose.

The charter membership roll will remain open until Dec. 10th, 1898, and it is expected that there will be a large number of charter members, since the present month is the beginning of a season when the mosses are at their best.

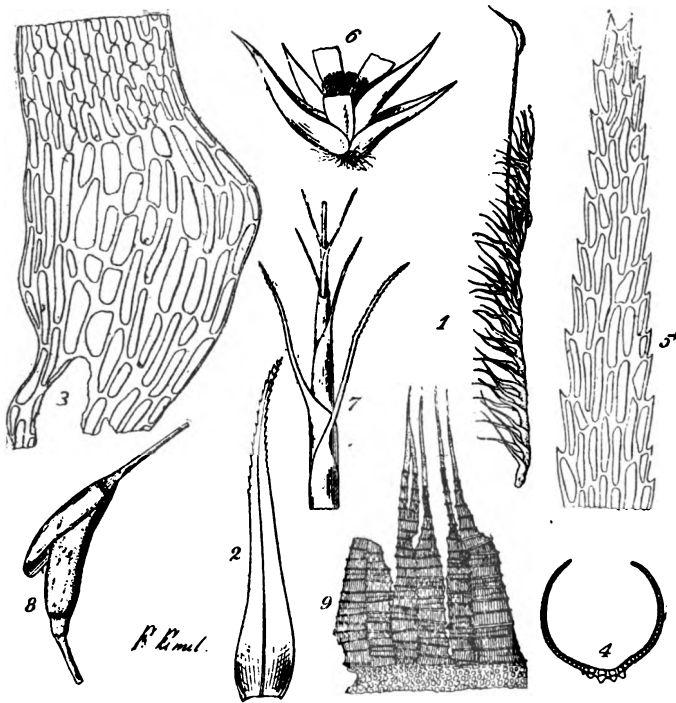
Only members of the Chapter will be entitled to the mosses offered in the *BRYOLOGIST* at the rates mentioned therein.

THE DICRANUMS.

THE Dicranums include some of our most common and easily recognized mosses, and they will be found in perfect fruit at the time this issue of the *BRYOLOGIST* reaches our readers. When one knows a single species of this genus, he will have little difficulty in recognizing the others, although it is not so easy to say just what characters give them their distinctive habit. The Dicranums usually grow in dense tufts or cushions which soak up water like a sponge and retain it for a long time. The leaves are usually bent to one side (secund), as if the wind had blown them strongly in one direction (Fig. 1). They are also usually curved like a scythe or a sickle (falcate).

The Dicranums are acrocarpous, but the stem grows on after the capsule has begun to develop, thus leaving the seta apparently starting from the side of the stem (Fig. 1). This often happens with acrocarpous mosses, but their erect habit and stems little divided or branched enable the acrocarpous mosses to be distinguished from the pleurocarpous even when sterile. The capsules are on long setae and are either curved (arcuate, Fig. 8) or drooping (cernuous), or straight. The operculum is long-beaked (rostrate), and the calyptra smooth and split down one side (cucullate, Fig. 8). The base of the seta is surrounded by a cluster of specialized leaves (the perichætal leaves, Fig. 7). There are perichætal leaves in the hair-caps, but they are much less strongly differentiated. The peristome is single—that is, it consists of one row of 16 jointed teeth, which are split half way down into two or three prongs (Fig. 9). It is strongly colored and makes a most beautiful microscopic object. Most of the species have at least the lower part of the stem covered with a

thick felt of radicles. The leaves are usually lanceolate to lance-subulate, with a concave base and a very strong costa extending nearly or quite to the apex of the leaf, or even beyond. Fig. 4 shows the leaf in cross section and also shows the narrow lamellæ, which are found on the *lower side* of the costa instead of the upper, as in the hair-caps. These lamellæ are often very strongly toothed. A section of the leaf is not necessary in order to see the lamellæ



DICRANUM SCOPARIUM.

Fig. 1, Plant natural size, the fruit terminal, becoming lateral by the growth of the stem; 2, single leaf enlarged; 3, part of base of leaf, showing the enlarged cells at basal angles, and the porose cells above; 4, cross-section of leaf showing the ridges on the back of the vein; 5, apex of leaf enlarged; 6, antheridial bud; 7, capsule with the calyptra and lid on; 8, capsule with the lid off, showing two teeth divided more or less irregularly to the middle. [From Mrs. Britton's article in the February, 1895, *Observer*. By permission].

clearly. If several leaves be mounted in water, some will nearly always be turned so as to show them in profile. This is rendered easier by the fact that in many species the edges of the leaves are rolled in (involute) in the upper part so that the leaves are tubulose. The upper leaf cells are elongated-rectangular, oblong-linear, quadrate or elliptical, according to the species; toward the base they are elongated-rectangular. Those at the basal angles are much enlarged and inflated, and are often of a different color from the others (Fig. 3, lower portion). This last character distinguishes the *Dicranums* from the allied genera and species except *Campylopus*, in which the seta is curved and the capsule pendent. Many of the species have the cells communicating by pores, as shown in the upper part of Fig. 3. Such cells are called porose or pitted. The protoplasm of the adjoining cells communicates through these pores. These pores are very helpful in determining the species.

While there are 20 species of *Dicranum* found in the United States north of Virginia and east of the Mississippi, there are only five that are likely to be found by the great majority of our readers. One of the most common and conspicuous is the broom moss (*D. scoparium*), so called because its leaves all point one way in a manner that reminds one of a hair-broom or counter-brush.* This is often used by florists and other merchants to form banks of dark green in their windows. It can be found almost anywhere in the woods, on the ground, roots of trees, and rocks. It is much the coarsest-appearing of the common species that have curved capsules. A reference to the figures will give all further details necessary for the identification of this species.

The wavy *Dicranum* (*D. undulatum*) also grows on the ground and rocks, but is the largest of the five species, and is at once distinguished in the field by its beautiful silky, strongly undulate leaves and clustered capsules. That is, it has several capsules with setæ inclosed in one cluster of perichæatial leaves (perichæatium). The leaf cells are elongated and porose, like those of the broom moss.

The fuscous *Dicranum* (*D. fuscescens*) grows on rotten wood, and is the only other common *Dicranum* with a curved capsule. It is easily distinguished from the preceding species by its smaller size, more delicate appearance, and leaves not undulate but

*Fide Mrs. E. G. Britton in the New York Teachers' Monograph, Vol. 1, No. 2.

crisped after the manner of curled hair. Its capsules are single, and much shorter and more strongly arcuate than in the above species. Under the microscope it is at once distinguished by the short upper leaf cells nearly or quite as broad as long and often quadrate. None of the leaf cells are porose (rarely a very few near the base).

Another species with curved capsules is the pale Dicranum (*D. pallidum*, *D. spurium condensatum* of L. & J. Manual). This is found on sandy plains in New Jersey and the neighboring territory, but is probably not found elsewhere within the range mentioned above. It is distinguished from all the above mentioned species by its small size (less than one inch in height); from the broom moss by its short irregular upper leaf cells with cell walls without pores, excepting a very few in the lower part; from the fuscous Dicranum by the more compact tufts, and leaves equally spreading, not secund, and little crisped.

There are two common species with erect straight capsules. Of these two, the flagellate Dicranum (*D. flagellare*) is much the more common. It is found in moist woods nearly everywhere. It grows on *decayed logs and stumps*, and often produces abundant flagellæ from the upper part of the plant. These flagellæ bear minute ecostate leaves very different from those on the main plant. In this species the costa does not extend to the apex of the leaf.

The other erect capsuled Dicranum, the fulvous Dicranum (*D. fulvum*) grows on *rocks* and has the costa excurrent—that is, extending beyond the lamina of the leaf into a thick point. In our next number we plan to publish an entirely new key to the whole twenty species. This key will be especially adapted to the use of beginners. We also hope to have some of the rarer species to distribute.

MICROSCOPIC PREPARATIONS OF MOSSES.

PORTIONS of the types of Hedwig's species, many of which are North American, and all of which date back to the beginning of this century, are preserved at the Boissier Herbarium in Geneva, mounted on small mica slides. The medium is a very durable one, for all the slides which I have examined have kept perfectly, and it seems to have been easily handled, for the specimens are not shrivelled or broken. I have since adopted this method for keeping all dissections that I make of the mosses,

and have also learned that others have done the same. I quote from the *Revue Bryologique* for 1893, M. Amann's remarks on this subject :

"The employment of mica slides for the preserving in the herbarium microscopic preparations of the organs of the mosses was recommended in 1853 by Carl Mueller in his 'Deutschlands Moose.' This eminent bryologist says in one of the numbers of *Natur* that thanks to this method, which permits the comparison under the microscope in a few minutes of the organs of a great number of species, it has been possible for him to devote himself to the systematic study of the mosses of the entire world.

"In fact, these microscopic preparations accompanying every specimen in the herbarium and enclosed in the same envelope with the specimen from which they were taken, permits a great economy of time and are for that reason exceedingly convenient."

M. Amann objects to them, however, as dry mounts, because of the imperfection of the image and because all our modern objectives are corrected for a standard thickness of cover-glass. He therefore prefers to use a small slide, only 25mm. long and $\frac{3}{4}$ mm. thick, which is specially made for anatomical preparations. As a mounting medium he uses gum arabic dissolved in glycerine jelly, thinned with distilled water, to the thickness of honey. Specimens transferred from either cold or hot water to this medium harden in a few hours and preserve indefinitely, being less bulky than ordinary slides for microscopic preparations.—*E. G. Britton.*

My method of making microscopic slides is as follows: Dissections are made in water on the stage of a simple microscope. This stage is removable so that it can be placed under a compound microscope and the smaller parts examined without disturbing their position. Such parts as I wish to retain are transferred to a few drops of dilute glycerine (10 to 20 per cent.) on a glass slide, on the end of which a number is marked with pen and ink for means of identification. This is set aside without cover glass until the water has entirely evaporated, leaving only clear glycerine. It usually requires at least an hour, generally more, unless the slide is placed where it will be warm (but not *hot*).

I usually leave it over night when convenient. After this it only remains to again transfer to hard glycerine jelly by almost any of the methods in general use. For the "permanent" slide and cover I now invariably use mica. The slides are fairly stiff and from $1\frac{3}{4}$ to 2 inches long by $\frac{3}{4}$ or $\frac{7}{8}$ wide, while the covers are thinner and $\frac{5}{8}$ by $\frac{1}{2}$ inch or larger, as the particular case demands. These slides are placed in small envelopes glued

to the herbarium sheets on which the plants, from which the dissections were made, are fastened. The necessary legend for identification is easily scratched on the mica with a metal point.

—J. Franklin Collins.

As some of our readers may not be familiar with glycerine jelly, it may be useful to state that it can be bought of any dealer in microscopical supplies. It can be softened for use by heating a bit on a slide, or by immersing the bottle in cold water and then raising the water to the boiling point, when the jelly will be liquefied. If a slide bearing a water or glycerine mount be slightly warmed, the jelly can be easily run under the cover glass by putting a drop on one side and drawing out the other medium at the other side with a piece of blotting paper. An ordinary kerosene lamp can be used to warm slides if nothing better is at hand.

Mr. Collins' method will do away with the shrinkage which is so troublesome when water mounts are transferred directly to the jelly. I once obtained a large quantity of excellent mica from a wall-paper factory where it was ground up to make the glittering specks in the wall-paper. This was much cheaper than the article ordinarily sold at hardware stores because of the small size of the pieces. I do not think that the ordinary moss mount requires a power high enough to render the variations in thickness of covers of very great importance and always use mica covers for my small slides.—A. J. G.

MOSES FOR DISTRIBUTION.

Specimens of *Dicranum scoparium*, *D. fuscescens*, *D. fulvum*, *D. flagellare*, and *D. pallidum* (this last by courtesy of Mr. C. F. Saunders) will be sent to any subscriber for 12 cents. A sterile specimen of *D. undulatum* will be added for an extra two cents if any failed to take advantage of Mr. Stultz's offer.

NEW AMERICAN MOSSES.

From Notes on California Bryophytes, by M. A. Howe in *Erythea*. 5: 92. 1897.

STABLERIA GRACILIS (Wils.) Lindb. "On charred stumps and logs, mainly of *Sequoia sempervirens*. First collected in Turner's Cañon between Cazadero and Fort Ross, Sonoma county, March 15, 1896; later at various stations in Mendocino county, and near Eureka, Humboldt county. Most of these specimens, in our judgment, cannot be distinguished even varietally from the European plants. The processes of the endostome are often as long

as the teeth, but they are so described by Boulay and by Husnot, and are sometimes equally long in Wilson's Musc. Brit. No. 220. *Stableria gracilis* was discovered by Wilson in Cheshire, England, in 1833. Since then, three or four English stations and two in Finistère, France, have been added. It is another interesting link in the chain of relationship between the bryophyte flora of California and that of Europe."

STABLERIA GRACILIS (Wils.) Lindb., var. *CALIFORNICA* M. A. Howe. "Leaves linear-lanceolate, acuminate, broader than in the typical form and without subulate points; antheridia surrounded by a few small bracts, on a short gemmiform branch. Near Eureka. The leaves of this variety are often strikingly different from those of the type, but it grows mingled with the ordinary form and plants bearing leaves of a transitional character are found. The specimens which we have identified with the type, so far as observed, are paroicous, but var. *Californica* appears always to be autoicous. Braithwaite describes *Stableria gracilis* as exhibiting both these methods of bearing the antheridia."

Stableria is a genus closely related to *Leptobryum pyri-forme* (L.) Wils., and for the benefit of our readers we insert Mr. Dixon's description of the species: "Stems densely tufted, slender, hardly branched, about $\frac{1}{4}$ - $\frac{1}{2}$ in. high, rarely taller, bright green, silky. Leaves flexuose, when dry somewhat curled, very narrow, linear-setaceous, the upper longest (1-1½ lines); margin plane, entire or obsoletely denticulate above, nerve vanishing at apex, narrow, rather indistinct above, areolation narrowly linear-rhomboid, at base wider, hexagonal-rectangular, hyaline. Seta short, less than $\frac{1}{2}$ in. high, pale, very slender; capsule suberect, narrowly clavate, with a slender tapering neck, thin-walled; lid acutely pointed. Peristome teeth incurved when dry, inserted below the mouth of the capsule; outer teeth narrow, distant; inner peristome a very short basal membrane with sixteen slender processes without intermediate cilia. Paroicous; antheridia in the axils of the comal leaves."

From Memoirs of the Torrey Botanical Club, 6 : No. 2.

BRACHYTHECIUM LAMPROCHRYSEUM GIGANTEUM n. var. Stems much stouter, secondary stems with fewer branches; stem leaves distant, longer, 3-3.5 mm. long, very strongly plicate; extreme alar cells inflated. Capsule ovoid; operculum conic-rostrate; annulus large, persistent; segments as long as teeth, from a very broad basal membrane; cilia 2 or 3, well developed, nodose; spores maturing in winter. Atku Id., Behring Sea. (U. S. S. Albatross, No. 44. June 10, 1894.)

BRACHYTHECIUM RIVULARE CATARACTARUM Sauter. Fl. Herzogth. Salzburg. 3 : 60. 1870. Floating, dark green to golden green, brown underneath; secondary stems much elongated, simple or sparingly branched; branches short, directed forward at an acute angle; leaves much more closely imbricated, especially at the tips of the branches. On timbers of old dam, Staley's Creek, Virginia.

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